THE MARINE BIOLOGICAL LABORATORY

SEVENTY-SIXTH REPORT, FOR THE YEAR 1973—EIGHTY-SIXTH YEAR

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I. TRUSTEES

Including Action of 1973 Annual Meeting

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PHILLIP B. ARMSTRONG, State University of New York, College of Medicine, Syracuse
ERIC G. BALL, Marine Biological Laboratory
DETLEV W. BRONK, The Rockefeller University

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Paul S. Galtsoff, Woods Hole, Massachusetts
Harry Grundfest, College of Physicians and Surgeons
Rudolf T. Kempton, Vassar College
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Charles W. Metz, Woods Hole, Massachusetts
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A. C. Redfield, Woods Hole, Massachusetts
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H. Burr Steinbach, Woods Hole, Massachusetts
Albert Szent-Györgyi, Marine Biological Laboratory
W. Randolph Taylor, University of Michigan

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STANDING COMMITTEES

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PHILIP B. DUNHAM, 1975
HARLYN O. HALVORSON, 1976
JAMES F. CASE, 1976
BRUCE WARREN
RUBERT ANDERSON
THOMAS J. M. SCHOFF
JAMES L. GERMAN III
ROBERT V. RICE
ANDREW SZENT-GYÖRGYI
DAVID YPHANTIS
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MELVIN SPIEGEL
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Laszlo Lorand
James Morin
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Anthony Liuzzi
Raymond E. Stephens

Research Space Committee
T. H. Goldsmith, Chairman
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H. Jannasch
Ruth Hubbard
Michael V. L. Bennett

Committee for the Nomination of Officers
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James F. Case
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A. Farmanfarmaian
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Computer Service Committee
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C. Levinthal
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Robert Gunning, Chairman
Donald Leh
Christine A. Leh
Manuel P. Dutra
Lewis Lawday
Frederick E. Thrasher

Employee Relations Committee
John Valois, Chairman
Lee Bourgoin, 1975
Ivan Valiela, 1975
Anthony Mahler, 1975
Lucena Barth, 1974
Robert Gunning, 1974
Catherine Henley, 1974
ACT OF INCORPORATION

II. ACT OF CORPORATION

No. 3170

COMMONWEALTH OF MASSACHUSETTS

Be it Known, That whereas Alpheus Hyatt, William Sanford Stevens, William T. Sedgwick, Edward G. Gardiner, Susan Minns, Charles Sedgwick Minot, Samuel Wells, William G. Farlow, Anna D. Phillips, and B. H. Van Vleck have associated themselves with the intention of forming a Corporation under the name of the Marine Biological Laboratory, for the purpose of establishing and maintaining a laboratory or station for scientific study and investigation, and a school for instruction in biology and natural history, and have complied with the provisions of the statutes of this Commonwealth in such case made and provided, as appears from the certificate of the President, Treasurer, and Trustees of said Corporation, duly approved by the Commissioner of Corporations, and recorded in this office;

Now, therefore, I, HENRY B. PIERCE, Secretary of the Commonwealth of Massachusetts, do hereby certify that said A. Hyatt, W. S. Stevens, W. T. Sedgwick, E. G. Gardiner, S. Minns, C. S. Minot, S. Wells, W. G. Farlow, A. D. Phillips, and B. H. Van Vleck, their associates and successors, are legally organized and established as, and are hereby made, an existing Corporation, under the name of the MARINE BIOLOGICAL LABORATORY, with the powers, rights, and privileges, and subject to the limitations, duties, and restrictions, which by law appertain thereto.

Witness my official signature hereunto subscribed, and the seal of the Commonwealth of Massachusetts hereunto affixed, this twentieth day of March in the year of our Lord One Thousand Eight Hundred and Eighty-Eight.

[SEAL]

HENRY B. PIERCE,
Secretary of the Commonwealth

III. BYLAWS OF THE CORPORATION OF THE MARINE BIOLOGICAL LABORATORY

(Revised February 11, 1972)

I. The members of the corporation shall consist of persons elected by the Board of Trustees.

II. The officers of the Corporation shall consist of a Chairman of the Board of Trustees, President, Director, Treasurer and Clerk.

III. The Annual Meeting of the members shall be held on the Friday following the second Tuesday in August in each year at the Laboratory in Woods Hole, Massachusetts, at 9:30 A.M., and at such meeting the members shall choose by ballot a Treasurer and a Clerk to serve one year, and nine Trustees to serve four years, and shall transact such other business as may properly come before the meeting. Special meetings of the members may be called by the Trustees to be held at such time and place as may be designated.

IV. Twenty-five members shall constitute a quorum at any meeting.

V. Any member in good standing may vote at any meeting, either in person or by proxy duly executed.

VI. Inasmuch as the time and place of the Annual Meeting of members are fixed by these bylaws, no notice of the Annual Meeting need be given. Notice of any special meeting of members, however, shall be given by the Clerk by mailing notice of the time and place and purpose of such meeting, at least (15) days before such meeting, to each member at his or her address as shown on the records of the Corporation.
VII. The Annual Meeting of the Trustees shall be held promptly after the Annual Meeting of the Corporation at the Laboratory in Woods Hole, Massachusetts. Special meetings of the Trustees shall be called by the Chairman, the President, or by any seven Trustees, to be held at such time and place as may be designated, and the Secretary shall give notice thereof by written or printed notice, mailed to each Trustee at his address as shown on the records of the Corporation, at least one (1) week before the meeting. At such special meeting only matters stated in the notice shall be considered. Seven Trustees of those eligible to vote shall constitute a quorum for the transaction of business at any meeting.

VIII. There shall be three groups of Trustees:

(A) Thirty-six Trustees chosen by the Corporation, divided into four classes, each to serve four years. After having served two consecutive terms of four years each, Trustees are ineligible for re-election until a year has elapsed.

(B) Trustees ex officio, who shall be the Chairman, the President, the Director, the Treasurer, and the Clerk.

(C) Trustees Emeriti, who shall be elected from present or former Trustees by the Corporation. Any member of the Corporation in good standing who has attained the age of seventy years, or has attained the age of sixty-five and has retired from his home institution, and who has served a full elected term as a regular Trustee, shall be designated Trustee Emeritus for life at the next annual meeting provided he signifies his wish to serve the Laboratory in that capacity. Any regular trustee who qualifies for emeritus status shall continue to serve as Trustee until the next Annual Meeting whereupon his office as regular Trustee shall become vacant and be filled by election by the Corporation. The Trustees ex officio and Emeriti shall have all the rights of the Trustees, except that Trustees Emeriti shall not have the right to vote.

The Trustees and officers shall hold their respective offices until their successors are chosen and have qualified in their stead.

IX. The Trustees shall have the control and management of the affairs of the Corporation. They shall elect a Chairman of the Board of Trustees who shall be elected annually and shall serve until his successor is selected and qualified and who shall also preside at meetings of the Corporation. They shall elect a President of the Corporation who shall also be the Vice Chairman of the Board of Trustees and Vice Chairman of meetings of the Corporation, and who shall be elected annually and shall serve until his successor is selected and qualified. They shall appoint a Director of the Laboratory for a term not to exceed five years, provided the term shall not exceed one year if the candidate has attained the age of 65 years prior to the date of the appointment. They may choose such other officers and agents as they may think best. They may fix the compensation and define the duties of all the officers and agents; and may remove them, or any of them except those chosen by the members, at any time. They may fill vacancies occurring in any manner in their own number or in any of the officers. The Board of Trustees shall have the power to choose an Executive Committee from their own number, and to delegate to such Committee such of their own powers as they may deem expedient. They shall from time to time elect members to the Corporation upon such terms and conditions as they may think best.

X. The Associates of the Marine Biological Laboratory shall be an unincorporated group of persons (including associations and corporations) interested in the Laboratory and shall be organized and operated under the general supervision and authority of the Trustees.

XI. The consent of every Trustee shall be necessary to dissolution of the Marine Biological Laboratory. In case of dissolution, the property shall be disposed of in such
manner and upon such terms as shall be determined by the affirmative vote of two-thirds of the Board of Trustees.

XII. The account of the Treasurer shall be audited annually by a certified public accountant.

XIII. These bylaws may be altered at any meeting of the Trustees, provided that the notice of such meeting shall state that an alteration of the bylaws will be acted upon.

RESOLUTIONS ADOPTED BY THE TRUSTEES:

I. RESOLVED:

(A) The Executive Committee is hereby designated to consist of not more than ten members, including the ex officio members (Chairman of the Board of Trustees, President, Director and Treasurer); and six additional Trustees, two of whom shall be elected by the Board of Trustees each year, to serve for a three-year term. (August 11, 1967.)

(B) The Chairman of the Board of Trustees shall act as Chairman of the Executive Committee, and the President as Vice Chairman. A majority of the members of the Executive Committee shall constitute a quorum and a majority of those present at any properly held meeting shall determine its action. It shall meet at such times and places and upon such notice and appoint such sub-committees as the Committee shall determine. (August 12, 1966).

(C) The Executive Committee shall have and may exercise all the powers of the Board during the intervals between meetings of the Board of Trustees except those powers specifically withheld from time to time by the Board or by law. (August 16, 1963).

(D) The Executive Committee shall keep appropriate minutes of its meetings, and its action shall be reported to the Board of Trustees. (August 16, 1963).

II. RESOLVED:

The elected members of the Executive Committee be constituted as a standing "Committee for the Nominations of Officers," responsible for making nominations, at each Annual Meeting of the Corporation, and of the Board of Trustees, for candidates to fill each office as the respective terms of office expire (Chairman of the Board, President, Director, Treasurer, and Clerk). (August 16, 1963).

III. RESOLVED:

Any member of the Corporation in good standing who has attained the age of seventy years, or has attained the age of sixty-five and has retired from his home institution, shall automatically be designated a Life Member of the Corporation provided he signifies his wish to retain his membership in the Corporation. Life Members shall not have the right to vote and shall not be subject to the payment of any dues. (February 16, 1973).

IV. REPORT OF THE DIRECTOR

To: THE TRUSTEES OF THE MARINE BIOLOGICAL LABORATORY

Speaking on the heritage of excellence at another famous institution, during the celebration of the one hundredth anniversary of the birth of William H. Welch, Alan Gregg said, "Something extraordinarily precious comes out of the close but entirely free association of men and women of superior character and capacity, because it lasts so
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long and because it never comes from or appeals to mediocrities.” He could have been describing the Marine Biological Laboratory.

It is one of the Director’s responsibilities to convey the spirit of the Laboratory not only to fellow scientists, but to foundations and the public at large. It is a formidable task. The greatness of the Laboratory cannot be assayed in a phrase. Now in its 87th year of service to world science, the Laboratory’s research and justly renowned summer courses have traditionally been—and remain—at the cutting edges of their respective fields.

We are justly proud of the twenty-nine winners of the Nobel Prize who have conducted various aspects of their work at the Laboratory, and of the nearly sixty members of the National Academy of Sciences who are also members of our Corporation (about ten per cent of the Corporation’s membership). However a roster of distinguished investigators tells only a part of the story. The life blood of the Laboratory is the student and beginning investigator, who finds in the unique scientific community of Woods Hole an exceptionally favorable environment for growth and maturation. The Laboratory’s greatness lies, in large part, in its insistence that teaching and research are inextricably interwoven.

Despite the inroads of inflation into our already meager resources, we have been firm in our resolve to increase the vitality of the Laboratory during the winter months. The appointment of E. F. MacNichol, Jr. as Assistant Director and his immediate and effective grasp of many problems of equipment and research services has enabled the Director to devote an increasing amount of his own time to fund-raising. During the year some two dozen foundations were visited; at least a dozen proposals have been submitted, with others in the offing.

The Henry L. and Grace Doherty Charitable Foundation has pledged $500,000 toward the establishment of an Ecosystems Center at the Laboratory. However the grant is contingent upon our securing additional funds to support the Center. Of the $2.5 million dollars needed to underwrite the Center for the first five years, over a quarter of that amount has been pledged. In addition to the Doherty commitment the Clowes Family Foundation has given and pledged $10,000 per year for at least four years and the Grass Foundation an additional $40,000. I am also pleased to report that the Rowland Foundation will provide $110,000 in 1974 and 1975 in support of MacNichol’s Laboratory of Sensory Physiology bringing the total amount for year-round programs to over $800,000. Securing the remaining funds is one of the priorities of our major fund raising campaign.

In this year’s efforts I have relied heavily on some of the “at large” officers and Trustees. Our Chairman, Denis Robinson and Treasurer, Mr. A. T. Daignault, and indeed all four at large Trustees have responded frequently to requests for assistance. Their location in New York, the seat of many of the foundations, has made Mr. Daignault and Mr. Golden especially vulnerable to the Director’s calls. It is against this background that I observe that the Trustees have moved to reapportion the composition of future classes. The Laboratory has thirty-six active Board members representing four classes of nine Trustees each. One new class is elected by Members of the Corporation at the annual meeting. In the past each class has included eight biologists elected by the Corporation and one “at large” member proposed by the Executive Committee and approved by the Corporation. In view of the shifting demands being placed on Trustees and the increasing need for our Board to represent a broader segment of the business and philanthropic population, it was felt by the Board that this ratio should be changed. Beginning in 1974 the Corporation Members will elect six biologist Trustees and approve the election of three at large Trustees by the Executive Committee. The first election under this new arrangement will take place at the 1974 Annual Meeting.
"Education for uncertainty"

We are passionately dedicated to the principle that the main hope for progress against
disease and the deterioration of the environment lies in research to which the student
should have early exposure. The critical turn of mind fostered by research tempers the
student's approach to the evolving base of science and its applications. It forms the
basis of what John Whitehorn termed "education for uncertainty."

In the past few years there has been a phasing out of federal grants for training
programs. However, at least in 1974 the Laboratory is still receiving federal support
for four of its summer courses and training programs. The National Institute of Child
Health and Human Development is funding the Research Program in Reproductive
Biology and the Embryology course. Dr. Eric Davidson heads the Embryology course
and Dr. Robin A. Wallace is coordinator of the Research Program in Reproductive
Biology.

The National Institute of Neurological Diseases and Stroke has announced it will
restore its support of the Frontiers in Research and Training Program. The Frontiers
Program was initiated in the summer of 1971 on an experimental basis through support
from the Institute. In 1973 the program suffered a serious cutback in funds.

The Frontiers Program is designed to introduce increasing numbers of well-qualified
scientists of minority ethnic groups into the neurosciences. It is an advanced training
program primarily for individuals at the postdoctoral level who are seeking further
experience in research or new ways of strengthening their capacity as instructors of
neuroscience. The Program Coordinator is Dr. James G. Townsel.

The National Science Foundation has announced its intention to support the Lab-
oratory's new program in History of Evolutionary Biology on a one-summer trial basis
in 1974. Dr. William Coleman of Johns Hopkins will head this summer's program
which will focus on the development of evolutionary doctrine from the late 18th to the
early 20th century.

Support for three summer programs will come from private foundations and indi-
viduals. The Grass Foundation continues to underwrite the Neurobiology course and
the Waksman Foundation will support the Marine Ecology course. We expect Dr.
Ernest B. Wright to continue his generous contribution to the Research Training
Program in Excitable Membrane Biophysics and Physiology, to which IBM is also
contributing.

During the month of January, 28 undergraduate students spent the "short-term" or
"mini-semester," as the period between the regular academic semesters is often called,
studying developmental biology at the Laboratory. The students came from a wide
variety of institutions that included the University of Wyoming, Texas A & I, Johns
Hopkins University and Smith and Mount Holyoke Colleges.

Dr. Louis E. DeLanney of Ithaca College was the coordinating instructor in coopera-
tion with the Director. The teaching staff included Dr. David Walters of Boston
University, Ms. Joanne Fortune, a laboratory instructor from Cornell, Doctors John
and Annette Coleman from Brown University and Doctors Lester and Lucena Barth,
resident scientific investigators at the MBL.

During the students' four-week stay they re-sided in the MBL dormitory. Their
schedule included two morning lectures five days a week, formal opportunities to use the
laboratories in the afternoon and informal day and night laboratory sessions with Dr.
DeLanney and Ms. Fortune.

In addition to the scheduled programs there were 18 guest seminars which gave the
students an opportunity to see how specialists in their field approach and solve scientific
problems. Investigators at the MBL and the Oceanographic Institution were among
the speakers at the seminar.
The Oceanographic Institution gave the students an afternoon tour of its facilities and an opportunity to go aboard the KNORR and observe how a vessel can be used for seagoing research. The students also went out on the Laboratory’s research vessel, the A. E. Verrill, and participated in collecting and towing.

Each student paid $850 to cover laboratory expenses and room and board. The students may receive four semester hours of credit at their own college for their intensive course work.

Plans are under way to expand the program in January, 1975, to include more students and to offer a greater selection of courses. Already scheduled in addition to Developmental Biology is a Neurobiology course from the joint MBL and the Boston University Marine Program, which will be taught by Doctors MacNichol, Fred Lang and Alan Fein. A grant made jointly to Boston University and the Laboratory by the Alfred P. Sloan Foundation will provide funds for equipment and scholarships.

Thus we continue to attempt, in John Shaw Billings’ words, “To give to the world men who cannot only sail by the old charts, but who can make new and better ones for the use of others.”

Losses—and gains

As 1973 drew to a close, Mr. Robert Kahler retired as Superintendent of Buildings and Grounds, after forty-seven years’ service, twenty-five of them as Superintendent. His length of service is impressive, of course, but the numbers tell only a small part of the story of his effective and unflagging service to the Laboratory.

Mr. Robert Gunning has been named to succeed Mr. Kahler.

Dr. Arnold Lazarow, Professor and Chairman of the Department of Anatomy at the University of Minnesota, received the highest honor of the American Diabetes Association at its twenty-third annual meeting in Chicago. He was the recipient of the Association’s Banting Medal and delivered the annual Banting Memorial Lecture.

Seven members of the Corporation were elected to the National Academy of Sciences in 1974: Drs. Martin Gibbs, a member of the staff of the Research Program in Experimental Marine Botany; Jerome Gross; Jerard Hurwitz; Alex Novikoff; Ladd Prosser, Trustee (Class of 1976); Sarah Ratner and DeWitt Stetten. Election to membership in the NAS is considered to be one of the highest honors that can be accorded to an American scientist. The fact that about ten per cent of the Corporation’s membership has been so honored (over five per cent of the total membership of the Academy in all fields are MBL biologists) continues to point to the Laboratory as one of the Nation’s leading centers of research and communication in the life sciences.

1. Memorial

ELMER G. BUTLER

By MALCOLM S. STEINBERG

All of his many friends at the Marine Biological Laboratory are saddened at the death of Elmer G. Butler, who passed away on February 23, 1972, after a brief illness. Born February 13, 1900, he graduated from Syracuse University and received the Ph.D. from Princeton University in 1926, where he shortly joined the faculty. Within eight years he rose to the chairmanship of the Department of Biology, a post he held until 1948.

A native of Parish, New York, Elmer Butler was well known for his contributions to the study of regeneration in amphibian extremities. His interest focused on the role of nerves in regeneration, and his last experiments dealt with the regeneration of extirpated segments of the spinal cord itself.
Active in many professional organizations, Dr. Butler was a Past President of AIBS, the American Society of Zoologists, and the Society for the Study of Development and Growth (now the Society for Developmental Biology). He had served as Chairman of N.I.H.'s Cell Biology Study Section and in editorial capacities for the Journal of Morphology, Developmental Biology, and the Journal of Experimental Zoology.

A member of the Corporation of the Marine Biological Laboratory since 1945, Elmer Butler served at various times on the Evening Lecture Committee, the Library Committee, the Buildings and Grounds Committee and the Nominations Committee. He was elected to four terms as Trustee (1951–55, 1955–59, 1960–64, 1964–68) and to three terms on the Executive Committee of the Board of Trustees (1952–54, 1956–58, and 1965–67). In all of these capacities he lent his council, always willingly and always in a quiet manner.

A generous and congenial man, it was characteristic of Butler's gentle humor for him to turn to a friend during the 1968 Annual Meeting of the Corporation, after Director H. Burr Steinbach's announcement of his election to the office of Trustee Emeritus, and add with a broad smile, "an honor long overdue"!

Eleanor and Elmer Butler had no children of their own, but one by one "adopted" Elmer's graduate students, all of whom retained and returned this devotion forever thereafter.

We join in extending to Eleanor our deepest sympathy.

2. The Staff

EMBRYOLOGY

I. Instructors

ERIC DAVIDSON, Associate Professor of Biology, California Institute of Technology, Director of course

GARY FREEMAN, Associate Professor of Biology, University of Texas, Associate Director of course

FOTIS KAFATOS, Professor of Biology, Harvard University

L. DENNIS SMITH, Associate Professor of Biology, Purdue University

IGOR DAVID, Staff Member, Carnegie Institution of Washington, Department of Embryology

JOSEPH GALL, Professor of Biology, Yale University

II. Special Lecturers

JOSEPH ILAN, Case Western Reserve University

EVERETT ANDERSON, Harvard University

PAUL SCHROEDER, Washington State University

RICHARD HALBERG, Cornell University

PAUL GROSS, University of Rochester

FRED WILT, University of California, Berkeley

BARBARA HAMKALO, University of California, Irvine

WILLIAM TELFER, University of Pennsylvania

ROBERT BRIGGS, University of Indiana

BURKE JUDD, University of Texas, Austin

DAVID EPEL, Scripps Institution of Oceanography

WALTER GEHRING, Yale University

PETER WELLAUER, Carnegie Institution of Washington
III. Technical Assistant

Christopher Amenson, Graduate Fellow, California Institute of Technology

IV. Laboratory Assistants

Gregory Britten, Marine Biological Laboratory
Barbara Ehrlich, Brown University

V. Lectures

Gary Freeman
Is oogenesis necessary for subsequent development?

Joe Gall
Chromosome activity during oogenesis

Eric Davidson
Synthesis and storage of RNA during oogenesis

Fotis Kafatos
Specific protein synthesis during chorion formation in insects

Dennis Smith
Protein synthesis during oogenesis and egg maturation

Igor Dawid
Mitochondrial development during oogenesis

Everett Anderson
Comparative ultrastructure of the female gamete

Paul Schroeder
Endocrine control of oocyte growth in annelids

Richard Halberg
Specific protein synthesis during oogenesis in Xenopus

Paul Gross
The synthetic organization of the sea urchin egg

Fred Wilt
Cytoplasmic polyadenylation of maternal RNA following activation of sea urchin eggs

Barbara Hamkaloi
Visualization of transcription in oocytes

William Telfer
Nurse cell function during oogenesis

Robert Briggs
The developmental genetics of the "o" mutation in the Axolotl

Burke Judd
The organization of the Drosophila chromosome

Joseph Ilan
Regulation of mRNA translation during development

David Epel
Molecular mechanisms of fertilization and egg activation

Walter Gehring
Genetic studies with reference to oocyte development

Peter Wellauer
Structure of ribosomal RNA

PHYSIOLOGY

I. Consultants

Arthur H. Burr, Assistant Professor, Simon Fraser University
Leon Weiss, Professor of Anatomy, Johns Hopkins University School of Medicine

II. Instructors

John J. Cebra, Professor of Biology, Johns Hopkins University
Pi-en-chien Huang, Associate Professor of Biochemistry, Johns Hopkins University School of Hygiene and Public Health

Ru-chih C. Huang, Associate Professor of Biology, Johns Hopkins University

Istvan Krisko, Associate Professor of Medicine, Baylor University School of Medicine

Brian J. McCarthy, Professor of Biochemistry, University of California, San Francisco

Thomas D. Pollard, Assistant Professor of Anatomy, Harvard University School of Medicine

Robert A. Prendergast, Associate Professor of Ophthalmology and Pathology, Johns Hopkins University School of Medicine
REPORT OF THE DIRECTOR

GERALD WEISSMANN, Professor of Medicine, New York University School of Medicine
DAVID A. YPHANTIS, Professor of Biochemistry and Biophysics, University of Connecticut, Storrs

III. SPECIAL LECTURERS

FRANK AUSTIN, Professor of Medicine, Harvard University School of Medicine
LUDWIG BRAND, Professor of Biology, Johns Hopkins University
CHRISTOPHER CORDLE, Department of Biology, Johns Hopkins University
ROBERT A. GOOD, Director, Sloan-Kettering Institute for Cancer Research
DANIEL GOODENOUGH, Assistant Professor of Anatomy, Harvard University School of Medicine
ELVIN A. KABAT, Professor of Microbiology, Human Genetics and Development, Columbia University, College of Physicians and Surgeons
MANFRED KARNOVSKY, Professor of Biological Chemistry, Harvard University School of Medicine
NEAL LANGERMAN, Assistant Professor of Biochemistry and Pharmacology, Tufts University School of Medicine
Fritz Lipmann, Professor of Biochemistry, Rockefeller University
John Marchalonis, Head, Laboratory of Molecular Immunology, Walter and Eliza Hall Institute for Medical Research
Peter Schiller, Laboratory of Chemical Biology, National Institutes of Health
Raymond E. Stephens, Brandeis University
DOUGLAS TAYLOR, Department of Biological Sciences, State University of New York at Albany
GEORGE WEBER, Professor of Pharmacology, Indiana University School of Medicine

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DENNIS BARRETT, Lecturer in Zoology, University of California, Davis
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SYLVIA HOFFSTEIN, Research Associate, New York University School of Medicine
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DELL L. MCCARTHY, Research Associate in Biochemistry, University of California Medical Center, San Francisco
DENNIS POWERS, Assistant Professor of Biology, Johns Hopkins University
ROBLEY WILLIAMS, JR., Associate Professor of Biology, Yale University

V. COURSE ASSISTANTS

MARTHA B. BARRETT, University of California, Davis
CALVINA BAUMGARTNER, Johns Hopkins University

VI. LECTURES

Thomas D. Pollard
I. Introduction to motile systems
II. The molecular basis of muscle contraction
III. Cytoplasmic actin and myosin: the molecular basis of cell motility

Sarah Hitchcock
IV. The regulation of muscle contraction and cell motility

Thomas D. Pollard
V. The relation of cytoplasmic contractile proteins to movement
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<td>David A. Yphantis</td>
<td>VII. Microtubule related movements: cilia and flagella</td>
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<td>R. Williams</td>
<td>VIII. Microtubule related movement in the cytoplasm</td>
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<tr>
<td>Ludwig Brand</td>
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<td>Peter Schiller</td>
<td>VIII. Microtubule related movement in the cytoplasm</td>
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<td>Application of fluorescence measurements to problems in biology</td>
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<td>Brian McCarthy</td>
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<td>Robert Prendergast</td>
<td>Physiological and genetic mechanisms of molecular adaptation to a changing environment I.</td>
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<tr>
<td>John Cebrá</td>
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<td>Robert Prendergast</td>
<td>Control of gene expression in early development</td>
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<td>Robert Prendergast</td>
<td>Mechanism of peptide elongation in protein biosynthesis</td>
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<td>John Marchalonis</td>
<td>Peptide chain initiation and termination</td>
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<td>John Cebrá</td>
<td>Mechanism of peptide bond formation—function of ribosomal proteins; species specificity</td>
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<td>Robert Prendergast</td>
<td>Studies on transcription and translation of specific genes I.</td>
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<td>Robert Prendergast</td>
<td>Studies on transcription and translation of specific genes III.</td>
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<tr>
<td>Robert Prendergast</td>
<td>Fractionation and sequence analysis of radioactive nucleic acid I.</td>
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<td>Robert Prendergast</td>
<td>Structure of interphase chromosomes</td>
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<td>Robert Prendergast</td>
<td>Fractionation of chromatin—background and approaches</td>
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<td>Robert Prendergast</td>
<td>Properties of fractionated chromatin</td>
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<td>Specificity of DNA/RNA hybridization reactions</td>
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<td>Robert Prendergast</td>
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<td>Robert Prendergast</td>
<td>The immune response</td>
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<td>Robert Prendergast</td>
<td>The activities of antibodies including their specific interactions with antigens</td>
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<td>Robert Prendergast</td>
<td>Antibodies: the structural bases of antigen-binding specificity and their genetic control</td>
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<td>Phylogeny of immune response</td>
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<td>Antibody forming cells and their precursors</td>
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<td>Gerald Weissmann</td>
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REPORT OF THE DIRECTOR

FRANK AUSTEN
ROBERT GOOD
FRIKT LIPMANN
NEAL LÄNGERMAN
DOUGLAS L. TAYLOR
DANIEL GOODENOUGH
ELVIN KABAT

Molecular basis of inflammation
Biological amplification systems in immunology
Nonribosomal polypeptide synthesis of some antibiotics
Calorimetric studies of thymidylate synthesis
The contractile basis of amoeboid movement: studies on isolated cytoplasmic models
Cell junctions and intracellular communication: biochemical and structural studies on isolated junctions
Attempts to make models of the polypeptide backbone of immunoglobulins and other proteins

EXPERIMENTAL MARINE BOTANY

I. Consultants

MARTIN GIBBS, Brandeis University
FRANK A. LOEWUS, State University of New York at Buffalo
RALPH S. QUATRANO, Oregon State University
JEROME A. SCHIFF, Brandeis University
W. RANDOLPH TAYLOR, University of Michigan
MICHAEL J. WYNNE, University of Texas

II. Instructor

JOHN A. WEST, University of California, Berkeley

III. Special Lecturers

JOE RAMUS, Yale University
GORDON F. LEEDALE, University of Leeds
JOHN LEE, City University of New York
G. F. PAPENFUSS, University of California, Berkeley

IV. Course Assistants

RICHARD WETHERBEE, University of Michigan
KENNETH MALINOWSKI, Yale University

EXPERIMENTAL INVERTEBRATE ZOOLOGY

I. Consultants

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CLARK P. READ, Professor of Biology, Rice University
ALFRED C. REDFIELD, Woods Hole Oceanographic Institution
W. D. RUSSELL-HUNTER, Professor of Zoology, Syracuse University
JAMES CASE, Professor of Biology, University of California, Santa Barbara

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JAMES MORIN, University of California at Los Angeles, Associate Director of course
M. J. GREENBERG, Florida State University
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HOWARD LENHOFF, University of California, Irvine
C. LADD PROSSER, University of Illinois
RUDI STRICKLER, Johns Hopkins University
STEVEN VOGL, Duke University
L. WILKENS, Bryn Mawr

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E. KRAVITZ, Harvard
FRED LANG, Boston University

V. Course Assistants

JOHN C. CORNELL, University of California, Berkeley, teaching assistant
MARY L. CORNELL, course secretary
BRIAN D. KELLER, Johns Hopkins University, teaching assistant

VI. Lectures

R. JOSEPHSON  Introduction to Woods Hole and the course
S. PIERCE  Some thoughts on the immortal sponges
R. JOSEPHSON  Relationships between animal phyla
T. SCHOFF  The biology of the bryozoa
M. GREENBERG  Mollusca I.
M. GREENBERG  Mollusca II.
J. MORIN  Protochordates
C. MANGUM  Annelida
A. KAMMER  Arthropod I.
A. KAMMER  Arthropod II.
J. MORIN  The enigmatic echinoderms
T. SCHOFF  Ecological genetics of marine invertebrates
C. MANGUM  Respiration I: gas exchange (homage to August Krogh)
C. MANGUM  Respiration II: oxygen transport (from monomer to the mudflat)
S. VOGL  Fluid and animals I: boundary layers and how they grow
M. GREENBERG  Fluid and animals II: flow adaptations of sessile animals
R. JOSEPHSON  Patterns of circulation in invertebrates
R. JOSEPHSON  The origin of nervous systems
REPORT OF THE TREASURER

A. Kammer  The generation of rhythmic motor outputs
J. Morin  Bioluminescence as diverse effectors
F. Lang  Arthropod neuromuscular systems
M. Greenberg  Comparative physiology and pharmacology of molluscan muscle

A. Kammer  Adaptations to environmental temperature
B. Heinrich  Thermoregulation in sphinx moths
J. Jennings  Digestive physiology in invertebrates, especially the acoelomates I.
J. Morin  Organization and coordination in colonial animals
J. Jennings  Digestive physiology in invertebrates, especially the acoelomates II.
T. Schopf  Extinction and sea floor spreading: crises in the history of life
R. Johnson  The amazing fossils of Mazon Creek or experimental invertebrate zoology 260 million years ago
S. Pierce  Salinity tolerance, osmosis and cell volume regulation
L. Kirschner  Water balance continued, and a look at excretory systems

MARINE ECOLOGY

I. Consultants
Harlyn O. Halverson, Professor of Microbiology, Brandeis University
J. Woodland Hastings, Professor of Biology, Harvard University
Howard L. Sanders, Senior Scientist, Woods Hole Oceanographic Institution
Lawrence B. Slobodkin, Professor of Biology, State University of New York at Stony Brook
Roger Y. Stanier, Professor of Microbiology, Institut Pasteur, Paris

II. Instructors
Holger W. Jannasch, Senior Scientist, Woods Hole Oceanographic Institution, in charge of program
Jane Gibson, Associate Professor of Microbiology, Cornell University
Edward R. Leadbetter, Professor of Microbiology, Amherst College
Kenneth H. Nealson, Assistant Professor of Marine Biology, Scripps Institution of Oceanography
Ralph S. Wolfe, Professor of Microbiology, University of Illinois

III. Research Associates
Anatol Eberhard, Assistant Professor of Chemistry, Ithaca College
Carolyn Eberhard, Research Associate, Cornell University
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Donald M. Spoon, Assistant Professor, Georgetown University
Craig D. Taylor, Postdoctoral Investigator, Woods Hole Oceanographic Institution
Edward O. Wilson, Professor of Zoology, Harvard University

IV. Laboratory Assistants
Christopher Van Raalte, Marine Biological Laboratory
Charles B. Markowitz, Amherst College
V. Special Lecturers

Richard W. Castenholz, Professor of Botany, University of Oregon
David P. Chynoweth, Associate Professor, University of Michigan
Joel C. Goldman, Assistant Scientist, Woods Hole Oceanographic Institution
Alex Keynan, Professor of Microbiology, The Hebrew University, Jerusalem
Ralph Mitchell, Professor of Applied Microbiology, Harvard University
John R. Postgate, Professor of Microbiology, The University of Sussex
John H. Ryther, Senior Scientist, Woods Hole Oceanographic Institution
Howard L. Sanders, Senior Scientist, Woods Hole Oceanographic Institution
Werner Stumm, Professor of Chemistry, Federal University, Zurich
John M. Teal, Senior Scientist, Woods Hole Oceanographic Institution

VI. Lectures

Holger W. Jannasch
Introduction to microbial ecology I
Introduction to microbial ecology II
Continuous culture at low substrate concentrations
Competition in continuous culture
Ecological aspects of denitrification
Experiments in deep-sea microbiology

Jane Gibson
Photosynthetic microorganisms I
Photosynthetic microorganisms II
Movement in photosynthetic bacteria
Biochemistry of CO₂-fixation
Biology of Bdellovibrio

Edward R. Leadbetter
Making a living aerobically
Enrichment cultures
Aspects of microbial geochemistry I
Aspects of microbial geochemistry II
Microbial attack on hydrocarbons
Amine utilization by bacteria

Kenneth H. Nealson
Regulation of bacterial bioluminescence
Basic bacterial genetics I
Basic bacterial genetics II
Survey of bioluminescent systems
Marine bacterial viruses

Ralph S. Wolfe
Anaerobic ways to make a living I
Anaerobic ways to make a living II
Anaerobic metabolic food chains I
Anaerobic metabolic food chains II
Iron bacteria

Richard W. Castenholz
Hot springs and their microorganisms I
Hot springs and their microorganisms II

David P. Chynoweth
Joel C. Goldman
Alex Keynan
Ralph Mitchell
John R. Postgate
Charles C. Remsen

Sulfide formation in sediments
Continuous culture of photosynthetic organisms
The bacterial endospore: an example of a dormant stage in microorganisms
Microbial predation and chemotaxis
Ecological consequences of recent knowledge of the biochemistry of nitrogen fixation
Survival of microorganisms
Fine structure survey of autotrophic and phototrophic bacteria
REPORT OF THE DIRECTOR

JOHN H. RYTHER
Aquaculture

HOWARD L. SANDERS
Oil spill ecology

DONALD M. SPOON
Protozoan ecology

WERNER STUMM
Biological mediation of redox processes in seawater
Role of redox potential and ecological milieu of microorganisms

CRAIG D. TAYLOR
Structure and methylation of co-enzyme M

JOHN M. TEAL
Experimental marsh ecology

EDWARD O. WILSON
Geographical ecology I
Geographical ecology II

NEUROBIOLOGY

I. INSTRUCTORS

MICHAEL V. L. BENNETT, Professor of Anatomy, Albert Einstein College of Medicine, co-director of course

JOHN E. DOWLING, Professor of Biology, Harvard University, co-director of course

ANTHONY L. F. GORMAN, Professor of Physics, Boston University School of Medicine

RODOLFO R. LLINAS, Professor of Physiology and Biophysics, University of Iowa

GEORGE PAPPAS, Professor of Anatomy, Albert Einstein College of Medicine

VICTOR P. WHITTAKER, Sir William Dunn Reader in Biochemistry, Cambridge University

II. SPECIAL LECTURERS

GEORGE KATZ, Columbia University

MALCOLM BRODWICK, Duke University

J. S. McREYNOLDS, National Institute of Neurological Diseases and Stroke

F. A. DODGE, JR., Rockefeller University

J. E. HEUSER, University College, London, England

S. D. Erulker, University of Pennsylvania

F. F. WEIGHT, National Institute of Mental Health

C. NICHOLSON, University of Iowa

H. GAINER, National Institutes of Health

M. J. DOWDALL, Cambridge University, England

E. J. SIMON, New York University Medical Center

F. HOSKIN, Illinois Institute of Technology

M. JOHNSON, Medical Research Council, England

E. A. KRAVITZ, Harvard Medical School

N. W. DAW, Washington University

III. LECTURES

JOHN DOWLING
Anatomical analysis of the vertebrate retina

R. LLINAS
Neurocytology of the cerebellar cortex: a model of general CNS morphology

M. V. L. BENNETT
The central dogma in neurobiology

GEORGE KATZ
Introduction to electrophysiological measurements

A. L. F. GORMAN
Introduction to anatomy and physiology of molluscan neurons

GEORGE D. PAPPAS
Membranes and fine structure of neurons and the fine structure of membranes
The fine structure of the chemically-transmitting synapses
ANNUAL REPORT OF THE MARINE BIOLOGICAL LABORATORY

S. G. Waxman  
The fine structure of electrically-transmitting synapses  
The structural specializations of the axon in relation to function

John E. Dowling  
Synaptic organization of the vertebrate retina

A. M. Brown  
Ionic movements in a molluscan neuron

A. L. F. Gorman  
Passive membrane properties of molluscan neurons and extracellular diffusion  
Electrogenic Na⁺ pump

Malcolm Brodwick  
Slow potassium conductance

J. S. McReynolds  
Comparative physiology of hyperpolarizing receptor potentials

R. Llinas  
General properties of chemically mediated synaptic transmission—the giant synapse

F. A. Dodge, Jr.  
The quantum of synaptic transmission

J. E. Heuser  
Origin and fate of synaptic vesicles

S. D. Erulkar  
Synaptic delay

M. V. L. Bennett  
Postsynaptic actions  
Inhibition

R. Llinas  
Receptor synapses

M. V. L. Bennett  
Synaptic potentials in sympathetic ganglia

M. V. L. Bennett  
Electrical synapses  
Interpretation of spikes in the CNS

R. Llinas  
Neuronal circuits in the cerebellar cortex  
Cerebellum in the regulation of movement

C. Nicholson  
Field potential analysis in the cerebellum

M. V. L. Bennett  
Physiology of electrical synapses  
Control of very simple effector systems  
Control of less simple effector systems

H. Gainer  
Effects of synaptic activity on macromolecular metabolism of neurons

V. P. Whittaker  
Biochemistry of the neurone—introduction  
Subcellular fractionation techniques applied to the nervous system

M. J. Dowdall  
Synthesis and storage of neurotransmitters: parallels and contrasts

V. P. Whittaker  
Dynamics of vesicle formation and discharge

E. J. Simon  
Biochemical studies on the opiate and other receptors

F. Hoskin  
Cholinergic drugs

H. Pollard  
The structure of chromatin granules (EM and X-ray)

D. Soifer  
Cyclic nucleotides in neuronal function  
Neuronal microtubules

M. Johnson  
Axonal degeneration

E. A. Kravitz  
Studies of synaptic chemistry in the lobster nervous system

J. E. Dowling  
Review: anatomy, chemistry, and physiology of photoreceptors  
The Limulus lateral eye

R. L. Chappell  
The median ocellus of the dragonfly: a “simple” retina

J. E. Dowling  
The processing of visual information

N. W. Daw  
Neurophysiology of color vision

J. E. Dowling  
Gross retinal potentials, glial potentials, and the problem of visual adaptation

M. H. Goldstein  
Processing of information in the auditory cortex
REPORT OF THE DIRECTOR

THE LABORATORY STAFF

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Lewis M. Lawday, Assistant Manager, Supply Department

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Robert Gunning, Superintendent, Buildings and Grounds
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Frederick E. Ward
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Joyce B. Enos
Clifford A. Gouday
David H. Graham
Robert O. Lehy

A. Dickson Smith
Eugene A. Tassinari
Bruno F. Trapasso
John M. Varao
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Independent Investigators, 1973

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    National Institute of Neurological Diseases and Stroke
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ANO, OSAMU, Associate Professor, Jichi Medical School, Tochigi-ken, Japan
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BARKER, JEFFERY LANGE, Special Fellow, National Institutes of Health
BARLOW, ROBERT B., JR., Associate Professor of Sensory Communication, Syracuse University
BARNES, STEPHEN N., N.I.H. Postdoctoral Fellow, Yale University
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BERKEN, JOZEF M. M. VAN DEN, Postdoctoral Research Associate, Duke University
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    of New York
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BOURNE, DONALD W., Research Biologist, Marine Research, Inc.
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    University of Basel, Switzerland
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    of Medicine
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CHAPPELL, RICHARD L., Assistant Professor, Hunter College of the City University of New York
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CLARK, VERNON, Associate Professor of Biology, North Carolina Central University
REPORT OF THE DIRECTOR

CLARK, WALLIS H., JR., Associate Professor of Biology, University of Houston
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COHEN, LAWRENCE B., Associate Professor, Yale University School of Medicine
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DAWSON, JACOB, Graduate Student, University of Toronto, Canada
DAWID, IGOR B., Staff Member, Carnegie Institution of Washington
DAWSON, M. JOAN, Postdoctoral Fellow, Columbia University
DE TERRA, NOEL, Assistant Member, The Institute for Cancer Research, Philadelphia
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FINE, JACOB, Director of Shock Research Division, Harvard Surgical Unit, Boston City Hospital
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Nakajima, Yasuko, Associate Professor, Purdue University
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Nelson, Leonard, Chairman, Department of Physiology, Medical College of Ohio
Nicholls, John G., Associate Professor of Neurobiology, Harvard Medical School
Nichols, Ruth Ann, Postdoctoral Research Associate, Purdue University
Nicholson, Charles, Assistant Professor, University of Iowa
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Prusch, Robert D., Assistant Professor of Biology, Brown University
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Reinisch, Carol L., Research Fellow in Medicine, Harvard University
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Salmon, Edward D., Postdoctoral, Brandeis University
Salzberg, Brian Matthew, Postdoctoral Fellow in Physiology, Yale University School of Medicine
Schein, Stanley Jay, Graduate Student, Albert Einstein College of Medicine
REPORT OF THE DIRECTOR

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Schofield, Thomas J. M., Associate Professor, University of Chicago
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Shepro, David, Professor, Boston University
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Stephens, Raymond Edward, Associate Professor of Biology, Brandeis University
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Wald, George, Higgins Professor of Biology, Harvard University
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ANNUAL REPORT OF THE MARINE BIOLOGICAL LABORATORY

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ANNUAL REPORT OF THE MARINE BIOLOGICAL LABORATORY

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SONNENBLICK, B. P., Professor of Zoology, Rutgers University
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WIERCINSKI, FLOYD J., Professor of Biology, Northeastern Illinois University
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WOLKEN, JEROME J., University Professor of Biophysics, Carnegie-Mellon University
YTENMA, CHESTER L., Professor of Anatomy, State University of New York, Upstate Medical Center

Students, 1973

All students listed completed the formal course program. Asterisk indicates completing post-course research program.

ECOLOGY

BALCH, WILLIAM E., University of Illinois
*BECVAR, JAMES E., Harvard University
*BREWER, LINDA A., Stanford University
CURTIS, PAUL R., Eisenhower College
FOX, GEORGE E., Syracuse University
*GREANEY, GEORGE S., Johns Hopkins University
*GREENBERG, EVERETT P., University of Massachusetts
REPORT OF THE DIRECTOR

HYDE, CAMILLE L., University of Michigan
*KEENAN, KATHERINE, City College of New York
*KIEFER, LYnda A., University of West Florida
McKAY, MELVIN G., Dalhousie University
SCHWALBE, CECIL R., University of Arizona
*STEIN, CAROL L., Harvard University
*STOLL, DENISE R., Boston University
WALTON, DIANA S., University of Illinois

EMBRYOLOGY

*BAKER, J. B., University of Hawaii
*BECKENDORF, S. K., California Institute of Technology
*CHYBA, D. E., University of Wisconsin
*COTTRELL, S. F., Rutgers University
*FELDBERR, C., University of Pennsylvania
*GABRIELLI, F., University of Wisconsin
*GALAU, G. A., California Institute of Technology
*HALL, L., University of British Columbia
*HOBART, P. M., Wesleyan University
*HUNSLEY, J. R., Michigan State University
*KAHN, E. B., Northwestern University
*LOOMIS, M. R., Indiana University
*NEWMAN, S. A., University of Chicago
*NORMAN, J. A., University of California
*OSTRER, H., Columbia University
*PINON, R., University of Washington
*Snyder, B. W., University of Michigan
*STEEL, L. F., Cornell University
*WYMAN, A. R., Harvard Medical School
*ZUNIGA, M., Yale University

EXPERIMENTAL BOTANY

AGNES, SISTER CECILIA, Regis College
AVERBACK, RAE RACHAEL, Bard College
BRAWLEY, SUSAN HOWARD, Wellesley College
Dean, John M., University of Massachusetts
DEHN, PAULA FAYE, DePauw University
FULTON, ALLICE BORDWELL, Brown University
LEVANDOSKI, DENNIS, Brooklyn College
LUHN, PATRICIA ANN, Drew University
POSTELLE, REBEKAH ANN, Tennessee Wesleyan College
RILEY, WILLIAM DENIS, University of Massachusetts, Boston
SCOTT, GORDON, University of Massachusetts
STAUD, RICHARD B., University of Wisconsin
STRAUS, JOHN WILLIAM, Earlham College
Williams, Deborah W., Harvard University, Radcliffe College
YEN, DUYENging, JENNETTE, Bryn Mawr College

PHYSIOLOGY

*BAILEY, STEPHEN, Washington University
BARNITZ, JOY, New College
BUBBERS, J. ERIC, Johns Hopkins University
*BURNS, ROY G., University of Edinburgh
COHEN, ROBERT M., Amherst College
DAVIS, FRANCIS M., Yale University
ANNUAL REPORT OF THE MARINE BIOLOGICAL LABORATORY

DEAN, Paula, Johns Hopkins University
DE MOSS, Harvard Medical School
DODGE, Robert H., Texas A & M University
FALLON, Ann M., Yale University
FINDLEY, Robert, Yale University
FITZGERALD, Gregory J., University of Dayton
FUJWARA, Keiji, University of Pennsylvania
GRAINGER, James L., University of California, Santa Cruz
HACKETT, Charles J., Wayne State University
HASKELL, Amy, College of William and Mary
HOFF, Steven F., University of California, Los Angeles
HOGG, James C., McGill University
HOPPENSTEADT, Frank, New York University
HUNT, Richard K., University of Pennsylvania
JOHANN, Carol A., University of Rochester
KAM, Zvi, University of California, San Diego
KIRBY, Christine A., University of Pittsburgh
KLEYN, John G., University of Puget Sound
KUPPERS, Rudolf C., University of California, Northridge
LITCHFIELD, William J., University of Illinois
LOWREN, Timo N-E., University of New Mexico
MADISON, Carolyn R., Newark State College
McCUMBER, Larry Joe, University of Florida
MEDNIEKS, Maija I., DePaul University
MILLER, Stella C., Johns Hopkins University
PARKER, Wendy L., City College of New York
REIMER, Ernest M., Simon Fraser University
RIBOLINI, Ann, State University of New York at Stony Brook
RICE, Charles M., University of California, Davis
ROTHBLUM, Lawrence I., Hahnemann Medical College
RUTZ, Richard E., Jr., Michigan State University
SANGER, Joseph W., University of Pennsylvania
SCHACHER, Samuel M., Columbia University
TUAN, Rocky S., Rockefeller University
WEISS, Martin B., University of Massachusetts, Amherst

INVERTEBRATE ZOOLOGY

BARTBERGER, Carol A., University of Maryland
BOLLEN, Andrew W., Harvard College
BOUTON, Rebecca K., Florida Atlantic University
BURSTEIN, Neal, Stanford University
COLLINS, James, Marquette University
CRABTREE, Robert L., Ohio University
DAY, Deborah, Universite’ Aix-en-Provence, Marseille
DONOHUE, Neil, Drew University
DYER, Ellen, Wilson College
EPSTEIN, Kerry, University of Oregon
FOWLER, Velia, Oberlin College
FREADMAN, Marvin, College of William and Mary
FRIEDLANDER, Michael, University of Illinois
GIRCH, Steve, Harvard University
HALL, Kathleen, University of Minnesota
HERBST, Gary N., University of Wisconsin
JENKINS, Carole, University of Pittsburgh
KEMP, William M., University of Florida
LEONARD, Stephanie, Oakland University
REPORT OF THE DIRECTOR

LING, Tsin Yuen Jeanne, University of Maryland
*MARTINI, Mary, University of California, Santa Barbara
*MYKLES, Donald L., University of California, Berkeley
NATHN, Sharon, Simmons College
OSBON, Maria, California State University, San Francisco
PRICE, Christopher H., Syracuse University
RADERMAN, Randie, State University of New York
*REINGOLD, Stephen C., Cornell University
*STOLPER, David, Upstate Medical Center
*SWENSON, Randolph P., Washington State University
WHEELER, Patricia, University of California, Irvine
ZEMKE, Stephen, Wesleyan University

NEUROBIOLOGY

BOHR, Vilhelm Alfred, University of Copenhagen
CALDWELL, John Henderson, Washington University
COUNTER, S. Allen, Harvard University
EATON, Robert Charles, University of California
FELDMAN, Jack L., University of Chicago
FORSYTHE, David William, Princeton University
HEYER, Carolyn Baker, University of Iowa
KIMBLE, Judith E., University of Copenhagen
KOVAC, Marc P., Stanford University
POLLARD, Harvey B., National Institutes of Health
SAMPLES, John Randall, Stanford University
SRINIVASAN, Mandyam Veerambudi, Yale University

FRONTIERS IN RESEARCH AND TEACHING PROGRAM

CLARK, Vernon, North Carolina Central University
STEPHENS, Lee B., California State University

4. FELLOWSHIPS AND SCHOLARSHIPS, 1973

Bio Club Scholarship:
  Katherine Keenan, Ecology Course
  Wendy L. Parker, Physiology Course

Gary H. Calkins Scholarship:
  Rebecca K. Bouton, Invertebrate Zoology Course
  Carole Jenkins, Invertebrate Zoology Course
  Michael Friedlander, Invertebrate Zoology Course
  Randie Raderman, Invertebrate Zoology Course
  Patricia Wheeler, Invertebrate Zoology Course

5. TRAINING PROGRAM

FERTILIZATION AND GAMETE PHYSIOLOGY RESEARCH TRAINING PROGRAM

I. INSTRUCTORS

Charles B. Metz, University of Miami, Program Director
Bjorn Alzelius, University of Stockholm, Sweden
Tom Humphreys, University of Hawaii
Joe Rosenbaum, Yale University
William Telfer, University of Pennsylvania
Robin Wallace, Oak Ridge National Laboratory
II. Assistants

Diane Robins, EM Assistant
Sylvia Ann Thompson Raaback, Program Secretary
Robert Spindell, Photographic Assistant

III. Trainees

Lester I. Binder, Yale University
Marguerite F. Knebel Bohm, University of Kansas
Donald C. Chang, Rice University
Christopher T. Cordle, Johns Hopkins University
Glenn E. Daniels, University of Pennsylvania
Mark N. Hill, Miami University
Paul A. Lefebvre, Rockefeller University
Anthony L. Mescher, Ohio State
Frederick W. Miller, Miami University
Phoebe Mounts, University of Pittsburgh
Paul A. Rosenberg, Albert Einstein Medical School
Barry W. Simon, Tulane University
Roger D. Sloboda, Rensselaer Polytechnic Institute
Andrea J. Tenner, University of California, San Diego
Donna L. Vogel, Albert Einstein Medical School
George B. Witman III., University of Chicago

IV. Lectures

Charles Metz
Marjorie Crandall
Bjorn Afzelius
Herbert Schuel
Joel Rosenbaum
George Witman
Lester Binder
Tom Humphreys
Sheldon J. Segal
Mareo Burgos

Mammalian sperm antigens and their roles in reproduction
Molecular complementary of yeast glycoprotein mating factors
Sperm morphology and fertilization biology
Molecular constituents of egg cortical granules. Function of tryptic
proteinase in fertilization
Flagellar regeneration in Chlamydomonas: A system for studying the
in vitro synthesis and assembly of microtubule
Directionality of microtubule assembly during flagellar regeneration in
Chlamydomonas
Directionality of microtubule assembly in vitro
Ribosomal and DNA-like RNA metabolism in sea urchin embryos
Specific and heterospecific transfer of hormone action by RNA
Maturation of the mammalian spermatozoon

Excitable Membrane Physiology and Biophysics Training Program

I. Consultants

W. J. Adelman, Jr., National Institute of Neurological Diseases and Stroke
K. S. Cole, National Institute of Neurological Diseases and Stroke
J. W. Moore, Duke University Medical Center
L. J. Mullins, University of Maryland, School of Medicine

II. Instructors

D. E. Goldman, Program Director, Medical College of Pennsylvania
F. A. Dodge, Associate Director, IBM Corp.
K. S. Cole, National Institute of Neurological Diseases and Stroke
J. W. Moore, Duke University Medical Center
D. Gilbert, National Institute of Neurological Diseases and Stroke
L. J. Mullins, University of Maryland, School of Medicine
M. P. Blaustein, Washington University
REPORT OF THE DIRECTOR

W. K. Chandler, Yale University School of Medicine
W. J. Adelman, Jr., National Institute of Neurological Diseases and Stroke
T. Narahashi, Duke University Medical Center
E. S. Masoro, Medical College of Pennsylvania
M. M. Dewey, State University of New York at Stony Brook
W. K. Blashé, University of Pennsylvania
H. LeCear, National Institute of Neurological Diseases and Stroke
L. E. Moore, Case Western Reserve University
C. L. Prosser, University of Illinois
C. M. Armstrong, University of Rochester
R. De Haan, Carnegie Institution of Washington
J. Tasaki, National Institute of Mental Health
L. Cohen, Yale University School of Medicine
H. Fishman, State University of New York at Albany
J. Y. Lettvin, Massachusetts Institute of Technology
R. S. Manalis, University of Cincinnati

III. Assistants
P. Greif, Haverford College
G. Stetten, Harvard College

IV. Trainees
R. F. Abercrombie, University of Maryland
D. M. Easton, Florida State University
W. F. Gilly, Washington University
R. S. Kass, University of Michigan
R. D. Nathan, University of California, Los Angeles
T. W. Pearson, University of California, Davis
J. F. Poduslo, University of Pennsylvania
J. M. Schaeffer, Purdue University
E. E. Swenberg, Brooklyn College
R. E. Yantorno, University of Pennsylvania

V. Lectures
D. E. Goldman  Physical and electrochemistry of membranes I.
               Physical and electrochemistry of membranes II.
               Physical and electrochemistry of membranes III.
K. S. Cole    Electrical properties of membranes
J. W. Moore   The strategy of the voltage clamp
               Operational amplifiers
               Preamplifiers
               Voltage clamp circuits
D. Gilbert    The biology of squid
L. J. Mullins  Passive transport
M. P. Blaustein Active transport
F. A. Dodge   Cable theory
W. K. Chandler Voltage clamp currents in squid
               The Hodgkin-Huxley formulation
               Univalent ions and selectivity
D. E. Goldman  Divalent cations
W. J. Adelman, Jr. The periaxonal space
L. E. Moore   Myelinated nerve
J. W. Moore   TTX and excitable membranes
W. J. Masoro  Chemical composition of membranes
M. M. Dewey   Electron microscopy and membrane structure
ANNUAL REPORT OF THE MARINE BIOLOGICAL LABORATORY

H. Lecar
Artificial membranes

W. K. Blasie
X-ray diffraction of membranes

T. Narahashi
Action of membrane "stabilizers"
Action of membrane "labilizers"

D. E. Goldman
Excitability models I.
Excitability models II.
Excitability models III.

C. M. Armstrong
Models for Na channels
Models for K channels

W. K. Chandler
Striated muscle I.
Striated muscle II.
Striated muscle III.

C. L. Prosser
Smooth muscle

R. De Haan
Electrical activity and entrainment of heart cells in culture

D. E. Goldman
Surface charges in axon membranes
Non-electrical stimulation of axons

I. Tasaki
Axon perfusion and membrane behavior

L. Cohen
Optical properties of axons

H. Fishman
Noise in the squid axon

J. Y. Lettvin
The relation between semi-conductors and electrolytes with respect to membranes

RESEARCH PROGRAM IN EXPERIMENTAL MARINE BOTANY

I. Senior Investigators

Martin Gibbs, Brandeis University
Frank A. Loewus, State University of New York at Buffalo
Ralph S. Quatrano, Oregon State University
Jerome A. Schiff, Brandeis University
Michael J. Wynne, University of Texas, Austin

II. Associate Investigators

Hans Gaffron, Florida State University
Robert C. Hodson, University of Delaware
Mary W. Loewus, State University of New York at Buffalo

III. Junior Investigators

Amitur Ben-Amotz, Weizmann Institute of Science, Israel
Scott E. Bingham, University of Rhode Island
Janice Ann Derr, Washington University, St. Louis
Franklin Fong, University of California at Riverside
Arthur C. Ley, Scripps Institute of Oceanography, San Diego
Dwight G. Peavey, Brandeis University, Waltham, Massachusetts
Dennis Shevlin, Duke University, Durham, North Carolina
Stuart G. Siddell, University of Warwick, England
Nicole Leveque, Pasteur Institute, Paris, France
David N. Young, University of California at Berkeley

IV. Lectures

D. Cheney
Current research in Eucheuma, a carrageenan producer from the south

N. Bishop
Vitamin E and photosynthesis

E. McCandless
Biochemical consequences of the sex life of Chondrus

D. A. Walker
Some aspects of photosynthetic induction

A. Trebst
Energy conservation in photosynthetic electron flow
## REPORT OF THE DIRECTOR


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**Total Attendance**

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<td>Less Persons represented in two categories</td>
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<td><strong>TOTAL</strong></td>
<td>708</td>
<td>707</td>
<td>728</td>
<td>726</td>
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**Institutions Represented—Total**

- Alabama, University of
- Albert Einstein College of Medicine
- American Museum of Natural History
- Amherst College
- Arizona, University of
- Bard College
- Beth Israel Hospital
- Boston City Hospital
- Boston College
- Boston University
- Boston University School of Medicine
- Brandeis University
- Brooklyn College, The City University of New York
- Brown University
- Bryn Mawr College
- California, University of, Berkeley
- California, University of, Davis
- California, University of, Irvine
- California, University of, Los Angeles
- California, University of, Riverside
- California, University of, San Diego
- California, University of, San Francisco
- California, University of, Santa Barbara
- California, University of, Santa Cruz
- California Institute of Technology
- California State University
- California State University, Long Beach
- Carnegie Institution of Washington
- Carnegie-Mellon University
- Case Western Reserve University
- Chicago, University of
- Cincinnati, University of
- Citadel, The
- City College, The City University of New York
- City of Hope National Medical Center
- Colby College
- College of Mount St. Joseph on the Ohio
- College of William and Mary
- Colorado, University of
- Colorado, University of, Medical Center
- Columbia University
- Columbia University, College of Physicians and Surgeons
- Connecticut, University of
- Connecticut, University of, Health Center
- Connecticut, University of, Medical School
- Cornell University
- Cornell University Medical College
- Dartmouth College
- Dayton, University of
- Delaware, University of
- Delaware State College
- De Paul University
- De Pauw University
- Drew University
- Duke University
- Duke University Medical Center
- Earlham College
- Eisenhower College

**Foreign Institutions Represented**

- 24
- 21
- 27
- 25
- 40
Emory University
Florida, University of
Florida Atlantic University
Florida State University
Georgetown University
Georgia, University of
Goucher College
Gulf Coast Research Laboratory
Hahnemann Medical College
Hartwick College
Harvard Medical School
Harvard University
Haverford College
Hawaii, University of
Herbert Lehman College, The City University of New York
Houston, University of
Howard University
Hunter College, The City University of New York
Illinois, University of
Illinois Institute of Technology
Indiana University
Institute for Cancer Research, The
Institute for Muscle Research
Iowa, University of
Ithaca College
Johns Hopkins University, The
Johns Hopkins University, The School of Hygiene
Johns Hopkins University, The School of Medicine
Juniata College
Kansas, University of
Kansas State University
Kentucky, University of
Kenyon College
Louisiana State University
Louisiana State University Medical Center
Lowell Technological Institute
Marquette University
Marine Research Foundation, Inc.
Maryland, University of
Maryland, University of, School of Medicine
Massachusetts, University of
Massachusetts General Hospital
Massachusetts Institute of Technology
Medical College of Ohio at Toledo
Medical College of Pennsylvania
Mellon Institute of the Carnegie-Mellon University
Miami, University of
Michigan, University of, School of Medicine
Michigan State University
Middlebury College
Minnesota, University of
National Bureau of Standards
National Institute of Mental Health
National Institute of Neurological Diseases and Stroke
National Institutes of Health
New College
New Hampshire, University of
New Mexico, University of
New York Blood Center, The
New York University
New York University Medical Center
New York University School of Medicine
Newark State College
North Carolina, University of, Chapel Hill
North Carolina Central University
North Carolina State University, Raleigh
Northeastern Illinois University
Northwestern University
Notre Dame, University of
Oak Ridge National Laboratory
Oakland University
Oberlin College
Ohio State University
Ohio University
Oregon, University of
Oregon State University
Pennsylvania, University of
Pennsylvania, Hospital of the University of Pennsylvania, University of, School of Medicine
Pittsburgh, University of
Population Council, The
Portland State University
Princeton University
Puget Sound, University of
Purdue University
Queens College, The City University of New York
Radcliffe College
Ramapo College of New Jersey
Regis College
Rensselaer Polytechnic Institute
Rhode Island, University of
Rice University
Rochester, University of
Rochester, University of, Medical School
Rockefeller University, The
Rush Medical College
Rutgers—The State University
Rutgers University Medical School
Scripp's Institution of Oceanography
Simmons College
Stanford University
State University of New York, Downstate Medical Center
State University of New York, Upstate Medical Center
State University of New York at Albany
State University of New York at Binghamton
State University of New York at Buffalo  Vassar College
State University of New York at Stony Brook  Veterans Administration Hospital, Brooklyn
Syracuse University  Virginia, University of
Temple University  Washington University
Temple University Health Sciences Center  Washington University School of Medicine
Temple University Medical School  Wayne State University
Tennessee Medical Units, University of  Wellesley College
Tennessee Wesleyan College  Wesleyan University
Texas A & M University  West Florida, University of
Texas Christian University  Western Kentucky University
Texas, University of, Arlington  Wilson College
Texas, University of, Austin  Wisconsin, University of
Trinity College  Wistar Institute
Tulane University  Woods Hole Oceanographic Institution
Upsala College  Worcester Polytechnic Institute
Vanderbilt University  Yale University
Yale University School of Medicine

FOREIGN INSTITUTIONS REPRESENTED, 1973

Basel, The University of, Switzerland  Montreal, University of, Canada
British Columbia, University of, Canada  Münster, University of, Germany
Calgary, University of, Canada  Nagoya City University, Japan
Cambridge, University of, England  Nara Medical University, Japan
CNR Laboratory of Molecular Embryology, Italy  Ottawa, University of, Canada
Copenhagen, University of, Denmark  Pasteur Institute, France
Dalhousie University, Canada  Queen Elizabeth College, England
Edinburgh University Scotland  Queen Mary College, England
Flinders University of South Australia, Australia  Simon Fraser University, Canada
Glasgow University, Scotland  Stockholm University, Sweden
Hebrew University Medical School, Israel  Tel-Aviv University, Israel
Jichi Medical School, Japan  Tokyo Kyoiku University, Japan
Karolinska Institute, Sweden  Toronto, University of Canada
Leeds, University of, England  Università degli Studi di Milano, Italy
London University, England  Université Laval, Canada
Max Planck Institute for Biophysical Chemistry, West Germany  University College, England
McGill University, Canada  Walter and Eliza Hall Institute of Medical Research, Australia
McMaster University, Canada
Medical Research Council, Toxicology Research Unit, England  Warwick, University of, England

8. FRIDAY EVENING LECTURES, 1973

June 28

SAUL ROSEMAN...............Sugar transport in bacteria
The Johns Hopkins University

July 6

JOSEPH G. GALL.................Repetitive DNA in Drosophila
Yale University
July 13

Keith R. Porter................. Studies on cell topography by scanning microscopy
University of Colorado

July 19

Patrick D. Wall................. Somatic sensory mechanisms in relation to
University College, London sensation
Alexander Forbes Lecturer at MBL

July 20

Patrick D. Wall................. Pain mechanisms as a special example of somato-sensory mechanisms

July 27

Seldon J. Segal................. The population problem: a progress report
The Population Council

August 3

John B. Buck................. The seventh sense: rhythm and synchrony in
National Institutes of Health fireflies and man

August 10

Annemarie Weber............... Information transfer in the actin filament
University of Pennsylvania, Medical School

August 17

Jean G. Baer.................... Forging the first link
University of Neuchatel
Agassiz Memorial Lecturer

August 24

M. S. Bretscher............... How are membranes put together?
Medical Research Council,
Cambridge

9. Members of the Corporation, 1973
Including Action of 1973 Annual Meeting

Life Members

Adolph, Dr. Edward F., University of Rochester School of Medicine and Dentistry, Rochester, New York 14627

Beam, Dr. Harold W., Department of Zoology, State University of Iowa, Iowa City, Iowa 52240

Behre, Dr. Elinor M., Black Mountain, North Carolina 28711
BERTHOLF, DR. LLOYD M., 1228 Gettysburg Drive, Bloomington, Illinois 61701
BODANSKY, DR. OSCAR, Department of Biochemistry, Memorial Cancer Center,
444 East 68 Street, New York, New York 10021
BRADLEY, DR. HAROLD C., 2639 Durant Avenue, Berkeley, California 94704
BROWN, DR. DUGALD E. S., Cape Haze, Box 426, Placida, Florida 33946
BURDICK, DR. C. LALOR, The Lalor Foundation, 4400 Lancaster Pike, Wilming-
ton, Delaware 19805
COLE, DR. ELBERT C., 2 Chipman Park, Middlebury, Vermont 05753
COWDRY, DR. E. V., 4580 Scott Avenue, St. Louis, Missouri 63110
DILLER, DR. IRENE C., 2417 Fairhill Avenue, Glenside, Pennsylvania 19038
DILLER, DR. WILLIAM F., 2417 Fairhill Avenue, Glenside, Pennsylvania 19038
FERGUSON, DR., JAMES K. W., 56 Clarkshaven St., Thornhill, Ontario, Canada
FURTH, DR. JACOB, 99 Fort Washington Ave., New York, New York 10032
GALTSSOFF, DR. PAUL, National Marine Fisheries Service, Woods Hole, Massa-
chusetts 02543
GRAY, DR. IRVING E., Department of Zoology, Duke University, Durham,
North Carolina 27701
HAMBURGER, DR. VIKTOR, Department of Zoology, Washington University, St.
Louis, Missouri 63110
HESS, DR. WALTER, 787 Maple Street, Spartanburg, South Carolina 29302
HIBBARD, DR. HOPE, 366 Reamer Place, Oberlin, Ohio 44074
HISAW, DR. F. L., 5925 S. W. Plymouth Drive, Corvallis, Oregon 97330
HOADLEY, DR. LEIGH, 985 Memorial Drive, Cambridge, Massachusetts 02138
HOLLAENDER, DR. ALEXANDER, Biology Division, Oak Ridge National Labora-
tory, Oak Ridge, Tennessee 37830
IRVING, DR. LAURENCE, University of Alaska, College, Alaska 99701
KAAN, DR. HELEN, P. O. Box 665, Woods Hole, Massachusetts 02543
KAHLER, ROBERT, Box 423, Woods Hole, Massachusetts 02543
LYNN, DR. W. GARDNER, Department of Biology, Catholic University of America,
Washington, D. C. 20017
MACDOUGALL, DR. MARY STUART, Mt. Vernon Apartments, 423 Clairmont
Avenue, Decatur, Georgia 30030
MAGRUDER, DR. SAMUEL R., Rte 4, Box 177, Kevil, Kentucky 42053
MALONE, DR. E. F., 6610 North 11th Street, Philadelphia, Pennsylvania 19126
MAYWELL, DR. REGINALD D., Department of Biology, Syracuse University,
Syracuse, New York 13210
MARSLAND, DR. DOUGLAS, 48 Church St., Woods Hole, Massachusetts 02543
MILLER, DR. JAMES A., Department of Anatomy, Tulane University, New
Orleans, Louisiana 70112
PAGE, DR. I. H., Cleveland Clinic, Euclid at E. 93rd Street, Cleveland, Ohio 44106
PAYNE, DR. FERNANDUS, Wesley Manor, 1555 N. Main St., Frankfort, Indiana
46041
PLOUGH, DR. H. H., 15 Middle Street, Rt. 1, Amherst, Massachusetts 01002
POLLISTER, DR. A. W., Department of Zoology, Columbia University, New York,
New York 10027
POND, SAMUEL E., 53 Alexander Street, Manchester, Connecticut 06044
SCHMITT, DR. FRANCIS O., 165 Allen Dale St., Jamaica Plain, Massachusetts 02130
SCHRADER, DR. SALLY, Duke University, Durham, North Carolina 27706
SCHRAMM, DR. J. R., Department of Plant Sciences, Indiana University, Bloomington, Indiana 47401
SEVERINGHAUS, DR. AURA E., 375 West 250th Street, New York, New York 10071
SMITH, DR. DIETRICH C., 216 Oak Forest Ave., Catonsville, Maryland 12128
SPEIDEL, DR. CARL C., 1873 Field Road, Charlottesville, Virginia 22903
STRAUS, DR. W. L., JR., Department of Anatomy, The Johns Hopkins University Medical School, Baltimore, Maryland 21205
STUNKARD, DR. HORACE W., American Museum of Natural History, Central Park West at 79th Street, New York, New York 10024
TAYLOR, DR. WM. RANDOLPH, Department of Botany, University of Michigan, Ann Arbor, Michigan 48104
Tewinkel, Dr. Lois E., 4 Sanderson Ave., Northampton, Massachusetts 01060
TURNER, DR. C. L., Northwestern University, Evanston, Illinois 60201
WARREN, DR. HERBERT S., % Leland C. Warren, 721 Conshohocken State Road, Penn Valley, Pennsylvania 19072
WEISS, DR. PAUL, The Rockefeller University, New York, New York, 10016
YOUNG, DR. D. B., Main Street, North Hanover, Massachusetts 02357

Regular Members

ABBOTT, DR. BERNARD C., Department of Biological Sciences, University of Southern California, University Park, Los Angeles, California 90007
ABBOTT, DR. MARIE B., Resident Systematist, Marine Biological Laboratory, Woods Hole, Massachusetts 02543
ACHE, DR. BARRY W., Department of Biological Sciences, Florida Atlantic University, Boca Raton, Florida 33432
ACHESON, DR. GEORGE H., Department of Pharmacology and Therapeutics, University of Cincinnati, College of Medicine, Eden and Bethesda Avenues, Cincinnati, Ohio 45219
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WALL, Dr. BETTY J., Department of Biological Sciences, Northwestern University, Evanston, Illinois 60201
WALLACE, Dr. ROBIN A., P. O. Box Y, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37890
WANG, Dr. A., Bedford Road, Lincoln Massachusetts 01773
WARNER, Dr. ROBERT C., Department of Molecular and Cell Biology, University of California, Irvine, California 92664
WARREN, Dr. LEONARD, Department of Therapeutic Research, University of Pennsylvania School of Medicine, Philadelphia, Pennsylvania 19104
WATERMAN, Dr. T. H., 610 Kline Biology Tower, Yale University, New Haven, Connecticut 06520
WATKINS, Dr. DUDLEY TAYLOR, Department of Anatomy, University of Connecticut, Farmington, Connecticut 06268
WATSON, Dr. STANLEY WAYNE, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts 02543
WEBB, Dr. H. MARGUERITE, Department of Biological Sciences, Goucher College, Towson, Maryland 21204
WEBER, Dr. ANNEMARIE, Department of Biochemistry, University of Pennsylvania, School of Medicine, Philadelphia, Pennsylvania 19104
WEBSTER, Dr. Ferris, Associate Director for Research, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts 02543
WEIDNER, Dr. Earl, Department of Zoology, Louisiana State University, Baton Rouge, Louisiana 70803
WEISENBERG, Dr. Richard, Department of Biology, Temple University, Philadelphia, Pennsylvania 19104
WEISS, Dr. Leon P., Department of Anatomy, The Johns Hopkins University, School of Medicine, Baltimore, Maryland 21205
WEISSMANN, Dr. Gerald, Professor of Medicine, New York University, 550 First Avenue, New York, New York 10016
WERMAN, Dr. Robert, Department of Zoology, Hebrew University, Jerusalem, Israel
WHITING, Dr. Anna R., Woods Hole, Massachusetts 02543
WHITING, Dr. Phineas, Woods Hole, Massachusetts 02543
WHITTAKER, Dr. J. Richard, Wister Institute of Anatomy and Biology, 36th Street at Spruce, Philadelphia, Pennsylvania 19104
WICHTERMAN, Dr. Ralph, Department of Biology, Temple University, Philadelphia, Pennsylvania 19122
WIERCINSKI, Dr. Floyd J., Department of Biology, Northeastern Illinois University, 5500 North St. Louis Avenue, Chicago, Illinois 60625
WIGLEY, Dr. Roland L., National Marine Fisheries Service, Woods Hole, Massachusetts 02543
WILBUR, Dr. C. G., Chairman, Department of Zoology, Colorado State University, Fort Collins, Colorado 80521
WILSON, Dr. Darcy B., Department of Pathology, University of Pennsylvania, School of Medicine, Philadelphia, Pennsylvania 19104
WILSON, Dr. Edward O., Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts 02138
WILSON, Dr. T. Hastings, Department of Physiology, Harvard Medical School, Boston, Massachusetts 02115
WILSON, Dr. Walter L., Department of Biology, Oakland University, Rochester, Michigan 48063
WINTERS, Dr. Robert Wayne, Department of Pediatrics, Columbia University, College of Physicians and Surgeons, New York, New York 10032
WITTENBERG, Dr. Jonathan B., Department of Physiology and Biochemistry, Albert Einstein College of Medicine, New York, New York 10461
WRINCH, Dr. Dorothy, Department of Physics, Smith College, Northampton, Massachusetts 01060
WYNNE, Dr. Michael J., Department of Botany, University of Texas, Austin, Texas 78710
WYSE, Dr. Gordon A., Department of Zoology, University of Massachusetts, Amherst, Massachusetts 01002
WYTENBACH, Dr. Charles R., Department of Zoology, University of Kansas, Lawrence, Kansas 66044
YNTEMA, Dr. C. L., Department of Anatomy, State University of New York, Upstate Medical Center, Syracuse, New York 13210
YOUNG, Dr. David Kenneth, Smithsonian Institution, Fort Pierce Bureau, RFD #1, Box 194-C, Fort Pierce, Florida 33450
Yphantis, Dr. David A., Department of Biochemistry and Biophysics, University of Connecticut, Storrs, Connecticut 06268
Zack, Dr. Sumner Irwin, The Pennsylvania Hospital, University of Pennsylvania School of Medicine, Philadelphia, Pennsylvania 19104
Zigman, Dr. Seymour, University of Rochester School of Medicine and Dentistry, 260 Crittenden Boulevard, Rochester, New York 14620
Zimmerman, Dr. A. M., Department of Zoology, University of Toronto, Toronto 5, Ontario, Canada
Zinn, Dr. Donald J., Department of Zoology, University of Rhode Island, Kingston, Rhode Island 02881
Zorzoli, Dr. Anita, Department of Physiology, Vassar College, Poughkeepsie, New York 12601

ASSOCIATE MEMBERS

Abelson, Dr. and Mrs. Philip H.
Ackroyd, Dr. and Mrs. Frederick W.
Adelberg, Dr. and Mrs. Edward A.
Adelman, Dr. and Mrs. William J.
Allen, Miss Camilla K.
Allen, Mrs. Nita M.
Alton, Mrs. Benjamin
Anderson, Dr. Everett
Andrews, Mr. William R.
Anthony, Mr. and Mrs. Richard A.
Armstrong, Mrs. Philip B.
Arnold, Dr. and Mrs. John
Bacon, Dr. Catherine L.
Bacon, Mr. Robert
Bakalar, Mr. and Mrs. David
Ball, Dr. and Mrs. Eric G.
Ballantine, Dr. and Mrs. H. T., Jr.
Banks, Mr. and Mrs. W. L.
Barker, Mrs. Anson
Barrows, Mrs. Albert W.
Bartow, Mrs. Clarence W.
Bartow, Mrs. Francis D. (S. R.)
Bartow, Mrs. Philip K.
Beale, Mr. and Mrs. E. F.
Bennett, Dr. and Mrs. Michael V. L.
Bernheimer, Dr. Alan W.
Biddle, Dr. Virginia
Boettiger, Dr. and Mrs. Edward G.
Bradley, Dr. Charles C.
Bronson, Mr. and Mrs. Samuel C.
Brown, Dr. and Mrs. Dugald E. S.
Brown, Dr. and Mrs. F. A., Jr.
Brown, Dr. and Mrs. Thornton
Buck, Mrs. John B.
Buffington, Mrs. Alice H.
Buffington, Mrs. George
Bunting, Dr. Mary I.
Burdic, Dr. C. Lalor
Burrough, Mrs. Arnold H.
Burt, Mr. and Mrs. Charles E.
Busser, Dr. and Mrs. John H.
Butler, Mrs. E. G.
Calkins, Mr. and Mrs. G. N., Jr.
Campbell, Mr. and Mrs. Worthington, Jr.
Carlton, Mr. and Mrs. Winslow G.
Carpenter, Mr. Donald F.
Cashman, Mr. and Mrs. Eugene R.
Chambers, Dr. and Mrs. Edward L.
Cheney, Dr. and Mrs. Ralph H.
Christman, Dr. and Mrs. George D.
Clark, Dr. and Mrs. Arnold M.
Clark, Mr. and Mrs. Hays
Clark, Mrs. James McC. (Cynthia)
Clark, Dr. and Mrs. Leonard B.
Clark, Mrs. LeRoy (Edna A.)
Clark, Mr. and Mrs. W. Van Alan
Clement, Dr. and Mrs. A. C.
Clements, Mr. and Mrs. David T.
Clowes, Mr. Allen W.
Clowes, Dr. and Mrs. G. H. A., Jr.
(Carol)
Cochran, Mr. and Mrs. F. Morris
Coffin, Mr. and Mrs. John B.
Houston, Mr. and Mrs. Howard E.
Huettner, Dr. and Mrs. Robert
Hunziker, Mr. and Mrs. Herbert E.
Inoue, Mrs. Shinya
Issokson, Mr. and Mrs. Israel
Janney, Mr. and Mrs. Wistar
Jewett, Mr. and Mrs. G. F., Jr.
Jones, Mr. and Mrs. Dewitt, III
Jordan, Dr. and Mrs. Edwin P.
Kahler, Mr. and Mrs. George A.
Kahler, Mrs. Robert W.
Kahn, Dr. and Mrs. Ernest
Kaighn, Dr. and Mrs. Morris E.
Keith, Mrs. Harold C.
Keith, Mr. Jean R.
Kennedy, Dr. and Mrs. Eugene P.
Kenefick, Mrs. R. G.
Keosian, Mrs. Jessie
Kinnard, Mr. and Mrs. L. R.
Kohn, Dr. and Mrs. Henry I.
Koller, Dr. and Mrs. Lewis R.
Lassalle, Mrs. Norman
Laster, Dr. and Mrs. Leonard
Lawrence, Mr. Frederick V.
Lawrence, Mrs. William
Lazarow, Dr. and Mrs. Arnold
Leemann, Mrs. Lucy B.
Lemher, Dr. and Mrs. Samuel
Levine, Dr. and Mrs. Rachmiel
Levy, Dr. and Mrs. Milton
Lillie, Mrs. Karl C.
Lobb, Prof. and Mrs. John
Lobb, Dr. and Mrs. Robert F.
Long, Mrs. G. C.
Lorand, Mrs. L.
Lovell, Mr. and Mrs. Hollis R.
Lowengard, Mrs. Joseph
Luria, Dr. and Mrs. S. E.
Mackey, Mr. and Mrs. William K.
MacNary, Mr. B. Glenn
MacNichol, Dr. and Mrs. Edward J., Jr.
Marks, Dr. and Mrs. Paul A.
Marlans, Dr. and Mrs. Douglas
Marvin, Dr. Dorothy H.
Mather, Mr. and Mrs. Frank J., III
Mayor, Mrs. James W., Sr.
McCusker, Mr. and Mrs. Paul T.
McElroy, Mrs. Nella W.
McGillicuddy, Dr. and Mrs. J. J.
McKenzie, Mr. and Mrs. Kenneth C.
McLane, Mrs. T. Thorne
McLardy, Dr. and Mrs. Turner
Meigs, Mr. and Mrs. Arthur
Meigs, Dr. and Mrs. J. Wister
Metz, Mrs. Charles B.
Meyers, Mr. and Mrs. Richard
Milman, Dr. and Mrs. Roger D.
Moloney, Dr. Albert M.
Montgomery, Dr. and Mrs. Charles H.
Moore, Dr. and Mrs. John W.
Morrell, Dr. Frank
Morse, Mr. and Mrs. Charles L., Jr.
Morse, Mr. and Mrs. Richard S.
Moses, Mr. and Mrs. George L.
Moul, Mrs. Edwin T.
Neuberger, Mrs. Harry H.
Newton, Miss Helen K.
Nichols, Mrs. George
Nickerson, Mr. and Mrs. Frank L.
Norman, Mr. and Mrs. Andrew E.
Okins, Mr. Armand
Packard, Mrs. Charles
Park, Mr. Malcolm S.
Park, Mr. and Mrs. Franklin A.
Parmentier, Mr. George L.
Patten, Mrs. Bradley M.
Pendergast, Mrs. Claudia
Pendleton, Dr. Murray E.
Pennington, Miss Anne H.
Perkins, Mr. and Mrs. Courtland D.
Person, Dr. and Mrs. Philip
Peterson, Mr. and Mrs. E. Gunnar
Philippe, Mr. and Mrs. Pierre
Porter, Dr. and Mrs. Keith R.
Prosser, Mrs. C. Ladd
Putnam, Mr. and Mrs. W. A., III
Ratcliffe, Mr. Thomas G., Jr.
Raymond, Dr. and Mrs. Samuel
Redfield, Dr. and Mrs. Alfred C.
Renek, Mr. and Mrs. Morris
Reynolds, Dr. and Mrs. George
Reznikoff, Dr. and Mrs. Paul
Riggs, Mr. and Mrs. Lawrason, III
Riina, Mr. and Mrs. John R.
Robb, Ms. Alison A.
Robertson, Dr. and Mrs. C. W.
Robinson, Dr. and Mrs. Denis M.
Rogers, Mrs. Julian
Ross, Mrs. John
Root, Mrs. Walter S.
Rowe, Mrs. William S.
Rugh, Dr. and Mrs. Robert
Russell, Mr. and Mrs. Henry D.
Ryder, Mr. and Mrs. Francis D.
Saunders, Dr. and Mrs. John W.
Saunders, Lawrence, Fund
Savery, Mr. Roger
Sawyer, Mr. and Mrs. John E.
Schlesinger, Mrs. R. Walter
Schroeder, Mr. Richard F.
Scott, Mrs. George T.
Sears, Mr. and Mrs. Harold B.
Sheinin, Dr. and Mrs. David
Shapiro, Mrs. Howard E.
Shepro, Dr. and Mrs. David
Sherman, Dr. and Mrs. Irvin
Smith, Dr. Frederick
Smith, Mrs. Homer P.
Smith, Mr. and Mrs. VanDorn C.
Speidel, Dr. and Mrs. Carl C.
Steinbach, Dr. and Mrs. H. B.
Stetten, Dr. and Mrs. Dewitt, Jr.
Stunkard, Dr. Horace
Sturtevant, Mrs. P.
Swanson, Dr. and Mrs. Carl P.
Sweeney, Dr. and Mrs. Thomas D.
Swope, Mr. and Mrs. Gerard L.
Swope, Mr. and Mrs. Gerard, Jr.
Swope, Miss Henriette H.
Taylor, Dr. and Mrs. W. Randolph
Thomas, Dr. and Mrs. Lewis

Tietje, Mr. and Mrs. Emil D.
Todd, Mr. and Mrs. Gordon F.
Tolkien, Mr. and Mrs. Norman N.
Tompkins, Mrs. B. A.
Trager, Mrs. William
Troll, Dr. and Mrs. Walter
Turner, Mrs. Robert
Valois, Mr. and Mrs. John
Veeder, Mrs. Ronald A.
Waksman, Dr. and Mrs. Byron H.
Waksman, Mrs. Selman A.
Wallace, Dr. and Mrs. Stanley L.
Wang, Dr. and Mrs. An
Ware, Mr. and Mrs. J. Lindsay
Warren, Dr. and Mrs. Shields
Watt, Mr. and Mrs. John B.
Weisberg, Mr. and Mrs. Alfred M.
Wexler, Mr. and Mrs. Robert H.
Wheatley, Dr. Marjorie A.
Wheeler, Mr. and Mrs. Henry
Wheeler, Dr. and Mrs. Paul S.
Wheeler, Dr. and Mrs. Ralph E.
Whiteley, Mr. and Mrs. G. C., Jr.
Whiting, Dr. and Mrs. Phineas W.
Whitney, Mr. and Mrs. Geoffrey G., Jr.
Wickensham, Mr. and Mrs. A. A.
Tilney
Wickensham, Mrs. James H., Jr.
Wichterman, Dr. and Mrs. Ralph
Wilber, Dr. and Mrs. Charles G.
Wilhelm, Dr. Hazel S.
Wilson, Mrs. Edmund B.
Wilson, Mr. and Mrs. Robert E., Jr.
Witmer, Dr. and Mrs. Enos E.
Wolfe, Dr. Charles
Wolfinson, Mr. and Mrs. Wolfe
Wrinch, Dr. Pamela N.
Yntema, Dr. and Mrs. Chester L.
Zwilling, Mrs. Edgar

V. REPORT OF THE LIBRARIAN

The library book section has expanded so rapidly that more room had to be found in the Lilly Building for additional shelving. Over 100 books were purchased with the Associates 1971 gift and a total of 710 books were added to this section this year.
The Woods Hole Oceanographic Institution received a substantial amount of money for books and will order approximately 1,500 volumes in 1974. Therefore Room 306 will be converted to library stack space and all books relating to Ocean Engineering, Physics, Mathematics and Marine Policy will be shelved temporarily in that room on the third floor.

Interlibrary loan requests continue to come in at a greater rate than the previous year. We average about 20 to 30 requests per day.

Two staff members left for other positions—Virginia Brandenberg, on the library staff for ten years, left to work in the Boston area and Cathy Glynn, Periodicals Librarian, also resigned. They have been replaced by Elizabeth Fuseler, formerly a librarian at the University of Pennsylvania, and Terry McKee, a 1973 graduate of Skidmore College.

The library is currently receiving 2,624 serial titles and holdings now total 151,764 volumes.

VI. REPORT OF THE TREASURER

The market value of the General Endowment Fund and the Library Fund at December 31, 1973, amounted to $2,154,552 and the corresponding securities are entered in the books at a value of $1,633,192. This compares with values of $2,579,583 and $1,624,597 respectively, at the end of the preceding year. The average yield on the securities was 4.18% of the market value and 5.52% of the book value. Uninvested principal cash was $2,433. Classification of these securities held in the Endowment Fund appears in the Auditor’s Summary of Investments.

The market value of the Pooled Securities at December 31, 1973, amounted to $1,088,355 as compared to book values of $930,340. These figures compare with values of $1,238,943 and $922,227 respectively, at the close of the preceding year. The average yield on the securities was 4.00% of the market value and 4.73% of the book value. Uninvested principal cash was in the amount of $823.

The proportionate interest in the Pool Fund Account of the various funds, as of December 31, 1973, is as follows:

<table>
<thead>
<tr>
<th>Fund</th>
<th>Interest Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pension Funds</td>
<td>30.41%</td>
</tr>
<tr>
<td>General Laboratory Investment</td>
<td>28.04%</td>
</tr>
<tr>
<td>F. R. Lillie Memorial Fund</td>
<td>2.04%</td>
</tr>
<tr>
<td>Other:</td>
<td></td>
</tr>
<tr>
<td>Bio Club Scholarship Fund</td>
<td>0.53%</td>
</tr>
<tr>
<td>Rev. Arsenius Boyer Scholarship Fund</td>
<td>0.64%</td>
</tr>
<tr>
<td>Garry N. Calkins Fund</td>
<td>0.67%</td>
</tr>
<tr>
<td>Allen R. Memhard Fund</td>
<td>0.12%</td>
</tr>
<tr>
<td>Lucretia Crocker Fund</td>
<td>2.21%</td>
</tr>
<tr>
<td>E. G. Conklin Fund</td>
<td>0.37%</td>
</tr>
<tr>
<td>Jewett Memorial Fund</td>
<td>0.19%</td>
</tr>
<tr>
<td>M. H. Jacobs Scholarship Fund</td>
<td>0.27%</td>
</tr>
<tr>
<td>Herbert W. Rand Fellowship</td>
<td>18.84%</td>
</tr>
<tr>
<td>Mellon Foundation</td>
<td>8.89%</td>
</tr>
<tr>
<td>Mary Rogick Fund</td>
<td>1.94%</td>
</tr>
<tr>
<td>Swope Foundation</td>
<td>4.90%</td>
</tr>
</tbody>
</table>
Donations from MBL Associates for 1973 amounted to $17,250 as compared with $10,755 for 1972. Unrestricted gifts from foundations, societies and companies amounted to $27,967.

During the year we administered the following grants and contracts:

<table>
<thead>
<tr>
<th>Investigators</th>
<th>Training</th>
<th>MBL Institutional</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 NIH</td>
<td>3 NIH</td>
<td>1 NSF</td>
</tr>
<tr>
<td>5 NSF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 EPA</td>
<td>1 Research Corp.</td>
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</tr>
<tr>
<td>1 MWPC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 NOAA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 API</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Damon Runyon Cancer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Merrill Trust</td>
<td></td>
<td></td>
</tr>
<tr>
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<td>4</td>
</tr>
<tr>
<td></td>
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<td>1</td>
</tr>
</tbody>
</table>

Most of the federally funded research grants and contracts provided for reimbursement of indirect costs on a cost per square foot basis for the laboratory space assigned to each project. A provisional rate of $12.25 per square foot was in effect throughout the year. Training courses supported by NIH grants were funded for indirect costs at a rate of 8% of allowable direct costs.

The following is a statement of the auditors:

To the Trustees of Marine Biological Laboratory, Woods Hole, Massachusetts:

We have examined the balance sheet of Marine Biological Laboratory as of December 31, 1973 and the related statements of operating expenditures and income and funds for the year then ended. Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances. We previously examined and reported on the 1972 financial statements.

In our opinion, the aforementioned financial statements (pages 75 to 79) present fairly the financial position of Marine Biological Laboratory at December 31, 1973 and 1972, and its operating expenditures and income for the years then ended, and the changes in its funds for the year ended December 31, 1973, and in conformity with the accounting principles referred to in Note A to the financial statements applied on a consistent basis.

The supplementary schedules (page 80) included in this report were obtained from the Laboratory’s records in the course of our examination and, in our opinion, are fairly stated in all material respects in relation to the financial statements taken as a whole.

Boston, Massachusetts
March 22, 1974

Coopers & Lybrand
REPORT OF THE TREASURER

It will be noted from the operating statement that the Laboratory activities for the year under review, amounted to a figure of a little over 1.8 million dollars, which amount is 150 thousand more than the preceding year.

ALEXANDER T. DAIGNAULT,
Treasurer

MARINE BIOLOGICAL LABORATORY
Balance Sheets
December 31, 1973 and 1972

Investments

<table>
<thead>
<tr>
<th></th>
<th>1973</th>
<th>1972</th>
</tr>
</thead>
<tbody>
<tr>
<td>Securities, at cost (approximate market quotation, 1973—$2,154,552; 1972—$2,579,583)</td>
<td>$1,633,192</td>
<td>$1,624,597</td>
</tr>
<tr>
<td>Cash</td>
<td>2,433</td>
<td>1,850</td>
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<tr>
<td></td>
<td></td>
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<tr>
<td>Investments held by Trustee:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,635,625</td>
<td>1,626,447</td>
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</tr>
</tbody>
</table>

Investments of other endowment and unrestricted funds:

<table>
<thead>
<tr>
<th></th>
<th>1973</th>
<th>1972</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pooled investments, at cost (approximate market quotation, 1973—$1,088,355; 1972—$1,238,943)</td>
<td>930,340</td>
<td>922,227</td>
</tr>
<tr>
<td>Other investments</td>
<td>1,366,230</td>
<td>1,094,752</td>
</tr>
<tr>
<td>Cash</td>
<td>1,571</td>
<td>31,516</td>
</tr>
<tr>
<td>Due from current fund</td>
<td>189,168</td>
<td>131,927</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Investments of other endowment and unrestricted funds:</td>
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</tr>
<tr>
<td>4,122,934</td>
<td>3,806,869</td>
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</tbody>
</table>

Plant Assets

<table>
<thead>
<tr>
<th></th>
<th>1973</th>
<th>1972</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land, buildings, library and equipment, at cost</td>
<td>12,454,336</td>
<td>12,453,416</td>
</tr>
<tr>
<td>Less allowance for depreciation (Note A)</td>
<td>2,726,028</td>
<td>2,444,052</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plant Assets</td>
<td>9,728,308</td>
<td>10,009,364</td>
</tr>
</tbody>
</table>

Current Fund Assets

<table>
<thead>
<tr>
<th></th>
<th>1973</th>
<th>1972</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>65,310</td>
<td>388,130</td>
</tr>
<tr>
<td>Inventories of supplies and bulletins</td>
<td>48,533</td>
<td>43,514</td>
</tr>
<tr>
<td>Other assets</td>
<td>5,912</td>
<td>5,581</td>
</tr>
<tr>
<td>Due to endowment funds</td>
<td>(189,168)</td>
<td>(131,927)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Fund Assets</td>
<td>183,176</td>
<td>541,201</td>
</tr>
</tbody>
</table>
ANNUAL REPORT OF THE MARINE BIOLOGICAL LABORATORY

MARINE BIOLOGICAL LABORATORY

BALANCE SHEETS

December 31, 1973 and 1972

<table>
<thead>
<tr>
<th>Invested Funds</th>
<th>1973</th>
<th>1972</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endowment funds given in trust for benefit of Marine Biological Laboratory</td>
<td>$1,635,625</td>
<td>$1,626,447</td>
</tr>
</tbody>
</table>

Endowment funds for awards and scholarships:

<table>
<thead>
<tr>
<th></th>
<th>1973</th>
<th>1972</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principal</td>
<td>449,777</td>
<td>427,702</td>
</tr>
<tr>
<td>Unexpended income</td>
<td>65,715</td>
<td>60,795</td>
</tr>
<tr>
<td></td>
<td>515,492</td>
<td>488,497</td>
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</tbody>
</table>

Unrestricted funds functioning as endowment

<table>
<thead>
<tr>
<th></th>
<th>1973</th>
<th>1972</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retirement fund</td>
<td>357,439</td>
<td>316,512</td>
</tr>
<tr>
<td>Pooled investments—accumulated loss</td>
<td>(112,225)</td>
<td>(60,505)</td>
</tr>
<tr>
<td></td>
<td>1,726,603</td>
<td>1,435,918</td>
</tr>
</tbody>
</table>

Unrestricted funds functioning as endowment

<table>
<thead>
<tr>
<th></th>
<th>1973</th>
<th>1972</th>
</tr>
</thead>
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<td>(60,505)</td>
</tr>
<tr>
<td></td>
<td>1,726,603</td>
<td>1,435,918</td>
</tr>
</tbody>
</table>

Unrestricted funds functioning as endowment

<table>
<thead>
<tr>
<th>Unexpended grants—research</th>
<th>1973</th>
<th>1972</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>359,899</td>
<td>28,293</td>
</tr>
</tbody>
</table>

Unexpended grants—research

<table>
<thead>
<tr>
<th>Unexpend balances of gifts for designated purposes</th>
<th>1973</th>
<th>1972</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>124,124</td>
<td>87,949</td>
</tr>
</tbody>
</table>

Unexpend balances of gifts for designated purposes

<table>
<thead>
<tr>
<th>Current fund Liabilities and Balances</th>
<th>1973</th>
<th>1972</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accounts payable and accrued expenses</td>
<td>20,677</td>
<td>26,333</td>
</tr>
<tr>
<td>Advance subscriptions</td>
<td>35,899</td>
<td>28,293</td>
</tr>
<tr>
<td>Unexpended grants—research</td>
<td>39,987</td>
<td>77,774</td>
</tr>
<tr>
<td>Unexpend balances of gifts for designated purposes</td>
<td>124,124</td>
<td>87,949</td>
</tr>
<tr>
<td>Current fund</td>
<td>(37,511)</td>
<td>320,852</td>
</tr>
<tr>
<td></td>
<td>$ 183,176</td>
<td>$ 541,201</td>
</tr>
</tbody>
</table>

The accompanying note is an integral part of the financial statements.

Note A—Accounting Principles: The following accounting principles have been reflected in the accompanying financial statements:

1. Investments are stated at cost.
2. Investment income is recorded on a cash basis.
3. Operating income is recorded when earned.
4. Expenses are recorded on an accrual basis.
5. Depreciation has been provided for plant assets at annual rates ranging from 1% to 5% of the original cost of the assets.
MARINE BIOLOGICAL LABORATORY

STATEMENT OF OPERATING EXPENDITURES AND INCOME

Years Ended December 31, 1973 and 1972

<table>
<thead>
<tr>
<th>1973</th>
<th>Salaries and Wages</th>
<th>Other Costs and Expenses (Note A)</th>
<th>Depreciation</th>
<th>Total</th>
<th>Charged to Grants</th>
<th>1973 Total</th>
<th>1972 Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instruction</td>
<td>$39,391</td>
<td>$75,584</td>
<td>$114,975</td>
<td>$230,972</td>
<td>$345,947</td>
<td>$375,613</td>
<td></td>
</tr>
<tr>
<td>Research</td>
<td>48,118</td>
<td>80,884</td>
<td>129,002</td>
<td>332,805</td>
<td>461,807</td>
<td>436,241</td>
<td></td>
</tr>
<tr>
<td>Dormitories</td>
<td>$24,890</td>
<td>50,884</td>
<td>100,980</td>
<td>176,754</td>
<td>176,754</td>
<td>166,876</td>
<td></td>
</tr>
<tr>
<td>Dining</td>
<td>103,376</td>
<td>103,376</td>
<td>103,376</td>
<td>108,745</td>
<td>108,745</td>
<td>108,745</td>
<td></td>
</tr>
<tr>
<td>Library</td>
<td>47,379</td>
<td>21,327</td>
<td>17,701</td>
<td>86,407</td>
<td>86,407</td>
<td>74,253</td>
<td></td>
</tr>
<tr>
<td>Back sets, serials and binding</td>
<td>71,915</td>
<td>71,915</td>
<td>71,915</td>
<td>51,674</td>
<td>60,674</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biological Bulletin</td>
<td>6,881</td>
<td>54,221</td>
<td>61,102</td>
<td>61,102</td>
<td>55,407</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Support services:

| Apparatus | 56,812 | 75,089 | 131,901 | 131,901 | 120,961 |
| Supply | 89,865 | 76,735 | 4,718 | 171,318 | 171,318 | 154,929 |
| Administration | 113,976 | 137,002 | 250,978 | 250,978 | 197,092 |
| Plant operation | 171,998 | 163,910 | 2,108 | 338,016 | 338,016 | 311,710 |
| Grant expenditures for support services | 15,810 | 15,810 | 19,296 | |
| Other | 42,309 | 42,309 | 42,309 | 38,293 | |

$511,801 $884,277 $281,975 1,678,053 579,587 2,257,640 2,120,110
### Income:

<table>
<thead>
<tr>
<th>Description</th>
<th>Fees</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instruction</td>
<td>$106,260</td>
<td>106,260</td>
</tr>
<tr>
<td>Research</td>
<td>355,016</td>
<td>355,016</td>
</tr>
<tr>
<td>Dormitories</td>
<td>$200,052</td>
<td>200,052</td>
</tr>
<tr>
<td>Dining</td>
<td>114,058</td>
<td>114,058</td>
</tr>
<tr>
<td>Library</td>
<td>27,721</td>
<td>42,549</td>
</tr>
<tr>
<td>Biological Bulletin</td>
<td>60,511</td>
<td>60,511</td>
</tr>
<tr>
<td>Support services:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apparatus</td>
<td>51,028</td>
<td>51,028</td>
</tr>
<tr>
<td>Supply</td>
<td>72,090</td>
<td>72,090</td>
</tr>
<tr>
<td>Administration</td>
<td>23,844</td>
<td>23,844</td>
</tr>
<tr>
<td>Investment income</td>
<td>160,435</td>
<td>160,435</td>
</tr>
<tr>
<td>Gifts used for current expense</td>
<td>39,217</td>
<td>39,217</td>
</tr>
<tr>
<td>Allowance for indirect costs</td>
<td>40,648</td>
<td>40,648</td>
</tr>
<tr>
<td>Grants for support services</td>
<td>15,810</td>
<td>15,810</td>
</tr>
<tr>
<td>Other</td>
<td>15,529</td>
<td>15,529</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$488,997</strong></td>
<td><strong>$819,961</strong></td>
</tr>
</tbody>
</table>

**Excess of current expenditures and depreciation over current income**: 369,095

**Reduction in plant funds for depreciation**: 281,975

**Excess current expenditures**: $87,120

The accompanying note is an integral part of the financial statements.
# Marine Biological Laboratory

## Statement of Funds

for the year ended December 31, 1973

<table>
<thead>
<tr>
<th></th>
<th>Balance December 31, 1972</th>
<th>Gifts and Other Receipts</th>
<th>Investment Income</th>
<th>Used for Current Expenses</th>
<th>Transfers To</th>
<th>Transfers From</th>
<th>Other Expenditures</th>
<th>Balance December 31, 1973</th>
</tr>
</thead>
<tbody>
<tr>
<td>Invested funds</td>
<td>$3,806,869</td>
<td>$105,793</td>
<td>$189,050</td>
<td>$160,434</td>
<td>$265,000</td>
<td>$920</td>
<td>$82,424</td>
<td>$4,122,934</td>
</tr>
<tr>
<td>Unexpended plant funds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unexpended research grants</td>
<td>$77,774</td>
<td>577,521</td>
<td></td>
<td></td>
<td>920</td>
<td>920</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unexpended gifts for designated purposes</td>
<td>$87,949</td>
<td>56,862</td>
<td>11,250</td>
<td></td>
<td>9,437</td>
<td></td>
<td>$124,124</td>
<td></td>
</tr>
<tr>
<td>Current fund</td>
<td>$320,852</td>
<td>(87,120) (1)</td>
<td></td>
<td></td>
<td>265,000</td>
<td>6,243</td>
<td></td>
<td>$39,987</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other gifts and receipts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$653,056</td>
<td></td>
</tr>
<tr>
<td>Grants for research, training and support</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appropriated from current income and other</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1) Excess of current expenditures over income</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appropriation for teaching laboratory</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>920</td>
</tr>
<tr>
<td>Scholarship awards</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11,854</td>
<td></td>
</tr>
<tr>
<td>Payments to pensioners</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>13,077</td>
<td></td>
</tr>
<tr>
<td>Loss on sale of securities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>57,493</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>15,680</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$99,024</td>
<td></td>
</tr>
</tbody>
</table>

The accompanying note is an integral part of the financial statements.
## MARINE BIOLOGICAL LABORATORY

### SUMMARY OF INVESTMENTS

December 31, 1973

<table>
<thead>
<tr>
<th>Securities held by Trustee:</th>
<th>Cost</th>
<th>Per cent of Total</th>
<th>Market Quotations</th>
<th>Per cent of Total</th>
<th>Investment Income 1973</th>
</tr>
</thead>
<tbody>
<tr>
<td>General endowment fund:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U. S. Government securities</td>
<td>$25,065</td>
<td>1.9</td>
<td>$24,800</td>
<td>1.4</td>
<td>$1,813</td>
</tr>
<tr>
<td>Corporate bonds</td>
<td>595,553</td>
<td>45.0</td>
<td>465,376</td>
<td>26.6</td>
<td>29,025</td>
</tr>
<tr>
<td>Preferred stocks</td>
<td>31,094</td>
<td>2.4</td>
<td>17,625</td>
<td>1.0</td>
<td>1,650</td>
</tr>
<tr>
<td>Common stocks</td>
<td>670,397</td>
<td>50.7</td>
<td>1,242,107</td>
<td>71.0</td>
<td>41,401</td>
</tr>
<tr>
<td></td>
<td>$1,322,109</td>
<td>100.0</td>
<td>$1,749,908</td>
<td>100.0</td>
<td>73,889</td>
</tr>
<tr>
<td>General educational board endowment fund:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U. S. Government securities</td>
<td>51,113</td>
<td>16.4</td>
<td>50,592</td>
<td>12.5</td>
<td>3,698</td>
</tr>
<tr>
<td>Other bonds</td>
<td>145,965</td>
<td>46.9</td>
<td>109,290</td>
<td>27.0</td>
<td>6,690</td>
</tr>
<tr>
<td>Common stocks</td>
<td>114,005</td>
<td>36.7</td>
<td>244,762</td>
<td>60.5</td>
<td>5,824</td>
</tr>
<tr>
<td></td>
<td>$311,083</td>
<td>100.0</td>
<td>$404,644</td>
<td>100.0</td>
<td>16,212</td>
</tr>
<tr>
<td>Total securities held by Trustee</td>
<td>$1,633,192</td>
<td>$2,154,552</td>
<td>$1,749,908</td>
<td>100.0</td>
<td>90,101</td>
</tr>
</tbody>
</table>

Investments of other endowment and unrestricted funds:

| Pooled investments:         |      |                   |                   |                   |                       |
| U. S. Government securities | 379,200 | 40.8              | 312,908           | 28.8              | 13,868                |
| Corporate bonds             | 488,933 | 52.5              | 711,709           | 65.4              | 22,522                |
|                            | $930,340 | 100.0               | $1,088,355        | 100.0             | 44,382                |

| Other investments:          |      |                   |                   |                   |                       |
| U. S. Government securities | 27,764  |                   |                   |                   | 1,323                 |
| Other bonds                 | 15,029  |                   |                   |                   | 750                   |
| Common stocks               | 588,016 |                   |                   |                   | 21,697                |
| Preferred stocks            | 2,871   |                   |                   |                   | 104                   |
| Real estate                 | 17,550  |                   |                   |                   | —                     |
| Short-term commercial notes | 715,000 |                   |                   |                   | 38,633                |
|                            | $1,366,230 |                   |                   |                   | 62,507                |

Total investments of other endowment and unrestricted funds: $2,296,570

Total: $196,640

Custodian’s fees charged thereto: (7,590)

Total investment income: $189,050